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PILOT STUDY TO DEVELOP A METHODOLOGY TO
FORECAST CANADIAN DEMAND FOR NEW HOME AND
BUSINESS TELECOMMUNICATIONS SERVICES IN THE
PERIOD 1980-1990

A Report Prepared for

DEPARTMENT OF COMMUNICATIONS

Roger W. Hough and Associates, Ltd.
Ottawa, Canada

Communications Studies and Planning, Ltd.
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May 1979

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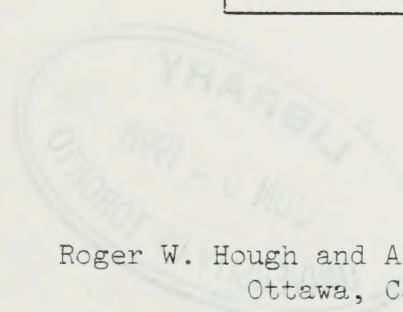
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PREFACE

This report was prepared for the Canadian Federal Department of Communications by Roger W. Hough and Associates, Ltd. of Ottawa, Canada and Communications Studies and Planning Ltd. of London, England, under Department of Supply and Services Contract No. 06SU.36100-8-1239. Hough and Associates were responsible for Chapters 1-3 and the first four major headings in Chapter 4 (pp. 27-63), and Communications Studies and Planning was responsible for the remainder of Chapter 4, Chapters 5 and 6, and Appendix A. Other parts of the report were prepared jointly.

We wish to extend our appreciation to the Department of Communications for its assistance in accomplishing this work, and in particular to Mr. Maurice Estabrooks, the Scientific Authority on the project.

ABSTRACT

The Canadian Federal Department of Communications has begun a program of research in New Home and Business Telecommunications Services, including what have recently come to be called 'teletext' or 'videotex' systems (i.e., systems that enable the receipt and display of text information on a television set); new entertainment services such as pay television; home protection services such as fire and burglar alarms; electronic funds transfer systems at home and in business; and "office of the future" systems including advanced word processing and electronic mail facilities. At this time, potential demand for these new services and others like them is largely unknown, despite the fact that some are in advanced stages of development. A program of research into the demand aspects was therefore needed, of which the present study is the first example. In it, some thirteen different methods for approaching demand assessment questions are identified and analyzed. These methods range from opinion questionnaire techniques such as Delphi, to traditional market research methods, field trials, retrospective surveys, the leading edge technique, historical analogy and diffusion of innovation methods, and such advanced techniques as mathematical models based on 'disaggregate' or 'behavioural choice' simulation.

The principal outcomes of the study are (1) a detailed assessment and evaluation of these methods for demand forecasting in the New Home and Business Services area and (2) the development of a program plan for undertaking demand research activities in these areas over the next three years in Canada. Recommendations are developed for both field trial and non-field trial research, including desk studies to assist in refining preliminary projections of market penetration, design of surveys to collect attitudinal information and other demand characteristics of potential users, and development of information required in demand models. Detailed program plans are laid out for this work including suggestions for accomplishing the studies in a modular fashion. In addition, the study includes a review of the present state of development of videotex and teletext services in Europe, a preliminary estimate of the relative importance of business versus home services in the videotex area, a partial list of potential services in the future, and an extensive bibliography.

EXECUTIVE SUMMARY

Within the next ten years, it appears likely that many new computer and telecommunications services will be offered to the public, both at home and in business. Examples of these are already beginning to appear throughout the world, for example, teletext and videotex services in the United Kingdom, France, Germany, and other European countries; pay television and automatic, 'telecommunicated' home security services in the U.S.; a wide range of new business services in many parts of the world; and the beginnings of some if not all of these services in Canada.

What is at issue in these endeavors is not technology, but economic feasibility and market demand, as may be seen by the fact that many of the same services have been discussed and predicted for as much as ten or fifteen years prior to 1979 and are still not in widespread use--the 'wired city' concept, the 'checkless society,' and teleconferencing as a substitute for travel being several examples.

In order to guard against similar unrealistic predictions of future developments in the 1980s, studies using proven, acceptable methods of demand forecasting and analysis are needed. The purpose of this report is to examine techniques for carrying out such tasks. In it, some thirteen methods for addressing demand assessment questions are identified and analyzed, including opinion questionnaire methods such as Delphi, extrapolation approaches using aggregate statistical data, methods requiring in-depth surveys of leading edge users of new technology, development of mathematical 'modal choice' or 'modal split' models, and survey approaches conducted in concert with field trials of new systems and services.

All of these methods have strong points and weaknesses. A clear preference emerges, however, for techniques that are 'observation-based' rather than 'opinion-based,' in order that the validity of forecasts to be derived can be demonstrated on the basis of comparisons with the growth and development in the past of other new technologically-based products and services. The report points out, for example, that the Delphi method and conventional market research techniques have not been shown to be especially useful in forecasting demand for clearly new products and services while extrapolation approaches, retrospective surveys, modal choice models and other observation-based methods are much more successful. Similarly, field trials often have their own deficiencies, due principally to the fact that demand assessment aspects are often not considered in the design of such trials, leading either to ignoring completely these aspects (in favor, for example, of addressing strictly technical questions) or treating them at most in an 'add-on' manner, that is, added on to trials originally designed for other purposes. In either of these cases, the opportunity for getting the most out of field trials for the collection of demand information is lost. In this report, therefore, we recommend strongly

that such trials, including those planned for videotex and teletext investigations in Canada, be planned so as to obtain the maximum amount of information possible from the trials. To do this requires designing and carrying out surveys and other data collection methods before, during, and after the trials, for the collection of each of the following types of information:

- Subjective data (i.e., user attitudes toward new services, reasons for use/non-use, awareness of service capabilities);
- Objective data (observed frequencies of use, costs of use, prices paid);
- Comparative data (information on purchase and use of competing services);
- Longitudinal data (changes in user response over time);
- Contextual data (information on the context in which the new service is to be introduced).

Information gathered from field trials can also be used to validate and calibrate mathematical models of demand, and we therefore recommend that these kinds of activities be carried out as well.

In addition to the above, the report includes three other basic types of information: (1) a detailed assessment of the methods being used in Europe to collect demand information from videotex and teletext trials; (2) a preliminary analysis of the potential for Telidon/videotex in residence and business markets in Canada; and (3) the development of a program plan for carrying out specific demand assessment studies in the New Home and Business Service area over the next three years.

Main points in the first category include the following:

1. Despite the widespread and highly visible teletext and videotex activity in Europe, only in two countries, the UK and Finland, has there been significant experience with 'real users' of such systems. Of these, the UK is by far the most advanced, since the activity has been undertaken on such a large scale (see below) and initial results of the trials are already beginning to appear.
2. The implementation of a videotex or teletext system, especially a videotex system, is a major undertaking, of which the terminal and computer centre technology are only a part. The UK Post Office, for example, is committed to spending £23 million (about \$52 million Cdn) over the two calendar years 1978/1979, and provisional authorities exist for expenditure of up to £100 million by 1983--figures

which do not include expenditures by Information Providers or manufacturers.

3. For these expenditures, the Post Office hopes to implement at least ten computer centres, serving 10,000 to 50,000 subscribers, with on the order of 400-500,000 pages of information in each data bank.
4. Initial results from the trials indicate a strong preference for games, horoscopes, and other light entertainment fare, as opposed to more substantive information retrieval such as encyclopedic data. What the long run results of these choices will be, however, is not as yet known.
5. The introduction of a videotex service is a much more complex matter than might have been supposed previously. Difficult issues have arisen, and continue to arise, in
 - pricing and marketing strategy
 - acceptability of videotex to users
 - form and quality of the data base
 - institutional structures and related legal and regulatory problems
 - standards and interworking.

A number of these are discussed in the report, at the end of Chapter 6.

Within the context of the potential for videotex in Canada, two particular points emerge. First, it may be necessary to take a somewhat more cautious view than reported so far as to the practical rate of penetration in the home market, and, second, there is no reason at all to assume that videotex is or will be exclusively of interest in the residence as opposed to business markets. By contrast, many small businesses, of which there are over one million in Canada employing 25% of the work force, could easily be users of appropriate versions of Telidon/videotex, especially if costs are low enough, and business applications are made attractive enough. We recommend, therefore, that these potential opportunities also be thoroughly explored, with a view toward developing as wide a market base for these systems as possible.

With respect to the third point mentioned above, our Recommendations for additional work in this area can be summarized as follows:

1. DOC should undertake a sponsored programme of user research designed to maximize the informational value of each of the service field trials of videotex/Telidon services undertaken in Canada, with the programme extended to other new home and business services as required.
2. The programme should begin with desk and non-field trial research methods which have been shown in the past to elicit substantially improved estimates of demand from relatively simple model formulations and field survey methods. These would include, as a minimum, development of statistical indices of the growth and development of other new computer, telecommunications, and 'high-technology' products; assessment of the demand characteristics of trials and demonstrations of new services occurring elsewhere; and analysis of competitive and complementary influences on the market for new home and business services.
3. To ensure that the best use is made of the forthcoming field trial opportunities, the design of the trials themselves and the field trial evaluation activity should be determined as far as possible within the framework of a systematic plan of demand assessment using formal economic and behavioural models. The maximum amount of demand information that can be obtained prior to field trial work should be obtained in the course of this preliminary work.
4. The DOC programme should include the provision of advice and assistance to the field trial operators in order to ensure that the selection of service content and of different types of users is such as to yield the greatest possibility of success. An advisory team, with appropriate experience and skills in social research and telecommunication field trial implementation and monitoring, should also be set up by DOC either in-house or under contract, to assist each field trial operator in:
 - (a) research design, and
 - (b) achieving a strategy for the content design, presentation, and marketing of the new service most likely to lead to greatest overall usage of the systems and services being trialed, and thus to maximum overall success.
5. DOC should make provision for the undertaking of detailed interview and self-completion surveys of users to be included in each field trial evaluation--with interviews before, during and (where appropriate) after the trial. This survey programme should be designed to obtain detailed descriptions of specific telecommunication events or 'transactions,' and of occasions when an existing telecommunication or non-telecommunication medium was preferred to the field-trial medium for the same purpose. Adequate provision should also be made for the collection of contextual information, and for automatic collection of usage data by the physical equipment used

in the trials--for example statistical parameters of traffic, and utilization of different types of content or serviceware.

6. A programme of work leading to the development and application of a family of econometric demand models should also be undertaken. This would involve four stages: model and data base design in the light of user requirements; programming, testing and documentation of the model; model validation and parameter estimation/calibration with real data from the field trials; and application of the model to production of demand estimates and policy analysis.
7. The proposed sequence of research modules should be assembled into five groups, as indicated in Exhibit 8-1 in the report, and provided for in research contracts covering each group.
8. Correspondingly, budgetary provision should be made on the scale corresponding to the set of modules selected for implementation by DOC, and the number of field trial evaluations sought.

Chapter 1

INTRODUCTION

On December 18, 1978, the Department of Communications issued a request for proposals (RFP) for a "Pilot Study to Develop a Methodology to Forecast Canadian Demand for New Home and Business Telecommunication Services in The Period 1980-1990." This request was responded to by some twenty to thirty organizations, and subsequently awarded to the present contractor, R.W. Hough and Associates Ltd., of Ottawa, in collaboration with Communications Studies and Planning Ltd. of London, England.

As outlined in the RFP, the study envisioned was to be very small in scope, and of limited duration. What was anticipated within that scope and duration however, was a preliminary investigation into various methods that had been used in the past for undertaking demand studies, an analysis and critique of these methods, an assessment of steps taken or being planned for achieving demand study goals in other countries, and, finally, a set of recommendations related to achieving demand study goals for new home and business services developing in Canada.

The present document is our report on this work. In it, we have attempted to be as comprehensive as possible, while at the same time realizing that the subject matter is immensely broad and difficult to deal with, leading to considerable controversy at times as to practical, efficient, and effective ways to approach demand study questions.

BACKGROUND AND INTRODUCTORY REMARKS

In general terms, there are two basic ways in which the question of demand for new services can be approached, namely, 'field-trial' and 'non-field trial' methods. While it may easily be recognized that in an ideal situation, 'trying something new out on real users,' i.e., the field trial approach,* should logically be preferred, a vast amount of experience has now shown that field trials often do not produce conclusive evidence (or even in many cases any evidence) as to user's wants, needs, desires, or future use of new services. On the contrary, what has actually happened in the recent past is exactly the opposite: a striking number of new telecommunication service initiatives, all tried out in the 'field', have failed dramatically to stimulate and nurture a dynamic, growing market. Among these initiatives are some famous ones, such as the U.S. Picturephone[®] activity, but there are many others not as well known, such as teleconferencing, facsimile (until recently a very sluggish service, and still so in Canada), and others.

* While this characterization cannot purport to be a definition of field trials, it is, in general, the principal objective of such trials.

Part of the reason for this situation, is that virtually all new service ideas come from the supply side of the equation rather than the demand side: they represent, therefore, technology push rather than demand pull. As has recently been pointed out in other documents,* this is understandable, and not necessarily reason in itself either to condemn new efforts nor to be skeptical that they will work. What recognition of failures should do for us, however, is to make us keenly aware of the risks inherent in assuming that because some new device or service can be developed and implemented technically, it will automatically be accepted by the public, i.e., either by households, business or government.

The particular relevance of these matters is revealed in the current Canadian initiatives in new home and business services--in particular, the Department of Communications' 'Telidon' project. This development is now well on its way to high level attention in the country, not only on the part of the DOC, but on the part of the federal government more generally--as a result of a recent allocation of some \$9 million to the project over the next four years, initiated by DOC and approved by Treasury Board--and on the part of the public as well, which has now heard a considerable amount about the project through press releases, demonstrations, and, most recently, the Clyne Committee report on Canadian sovereignty in telecommunications, published and released in April. (Consultative Committee...1979). This document, as is well known to many readers of the present report, was very supportive of the development of Telidon, as well as other new home and business telecommunication services, and made specific recommendations in that regard. In particular, it suggests that

The federal government should vigorously promote the development of plans for the manufacture and marketing of the Telidon information system and ancilliary equipment. This should probably take the form of a joint venture involving major participation by the private sector and investment from both the federal and some provincial governments. It might also suitably involve "chosen instruments" in the manufacture and the commercial development. In following this course the Department of Communications should assume leadership.+

In other words, the government of Canada is very much behind the venture, wishes to encourage and support it, and is willing to put money into the

* See for example, the recent LINK Butler-Cox report on Viewdata (LINK, Butler-Cox, 1978).

+ Recommendation 22, p. 84.

activity, to get it going as rapidly, substantially, and efficiently as possible--with, of course, due attention to encouraging the private sector to follow suit and put money behind their support as well.

Unfortunately, it is in the last part of this statement that the real difficulty arises, in our view, because such a venture needs private capital, initiative and ingenuity to make it work. But these ingredients are often not forthcoming from private enterprise in Canada until a well-defined, obvious, and (usually) substantial market has been either demonstrated already elsewhere, or is thought to be a low-risk, high-potential-return venture.

Meanwhile, of course, other countries that are not similarly constrained to develop private funding for such initiatives--countries such as the United Kingdom, France, Germany, Sweden, Finland, Japan, and Spain--are all proceeding apace with their developments; and, moreover, the United States, with its immense technological know-how and manufacturing expertise could be ready to jump into the fray with a terminal at half the cost, and half the price also if necessary, when convenient to its manufacturers' overall market plans and prospects.

These situations all give one pause for concern. On the one hand, if Telidon and other Canadian innovations and initiatives are to bear fruit, they must do so at least at costs that will at some appropriate future time be competitive with other systems, services and devices that are likely to be available from other world suppliers, and, ideally, at costs that will enable the devices and systems to compete vigorously and dynamically for world markets of their own. Experience has shown that this will not be assured simply by establishing Telidon as an international standard of some sort, important as that step might be. On the contrary, all too often, standards follow markets, rather than the other way around.

What this suggests, therefore, is the obvious necessity of establishing--as carefully, rigorously, and 'dispassionately' as possible--realistic, well documented estimates of the potential future market for such systems. To do this we will be suggesting that both field trial and non-field trial methods be used, on the basis that evidence from many quarters is necessary to achieve the objective of having confidence in the overall results. With respect to field trials, for example, we have already suggested that often, convincing demand data does not become available; however, this does not mean that such trials cannot be designed to derive respectable, substantial, and meaningful market information, but that they should be so designed to accomplish those goals effectively. Moreover, even trials that have not specifically been developed with the collection of demand data in view, can be utilized to provide augmented information useful in market forecasting and prediction studies.

In addition to such work, it is our strong view that non-field trial methods are essential also. Here, as we will demonstrate presently, we do not have in mind simple 'opinion surveys', since these also have been shown many times in the past to have a less than desirable track record in forecasting markets for clearly 'new' products and services. Instead, we examine in considerable detail, innovative, but already proven methods that have been used, and are continually being improved, for just such endeavors. Included in such methods are the so-called 'leading-edge' approach, the development of 'transaction' models, carrying out of 'retrospective' surveys, the development of 'disaggregate' activity models, analysis of competing and complementary techniques and technologies, and a number of others.

SCOPE AND OBJECTIVES OF THE RESEARCH

Scope

Despite the mention above of Telidon and other new home and business services of a similar nature (generally classed as 'videotex' and/or 'teletext' systems today), it should be noted that this study is not confined to these types of systems. Rather, its scope is intended to cover all new home and business service possibilities that can be envisioned to occur in the near future, i.e., approximately the next ten years. Thus, such developments as pay television, home protection services, electronic newspapers and message systems, "pay by phone" services, home computers and games, and a similarly broad range of possibilities in the business sector are all within the domain of the study. This is not to say, it should be clearly noted, that forecasts for these services will be found herein. On the contrary, the study reports only on methodologies for forecasting and demand assessment, not on forecasts themselves. Indeed, to undertake demand research in any of these areas, even by themselves, is usually a major undertaking. The important point to bear in mind is that the methodologies described and discussed in the report are applicable for all types of new product and service endeavors, in both business and residence sectors.*

Objectives

The objectives of the research are best described by referring to the terms of reference for the study, from which the following tasks are quoted:

* The reader will note that in some sections of the report we have used videotex and teletext systems as examples to a greater degree than other new types of home and business services. This is not meant to distract, however from the more generalized applicability of the methods discussed in the report, as outlined above.

1. An identification and preliminary investigation of relevant "Soft Modeling" techniques which are used to forecast the demand for a new product or service.
2. An aggregation of the various New Home and Business Services, which might be offered during a 10-year time frame, into homogeneous groups which may be expected to have similar demand characteristics.
3. A review of the British, French and American field trials, with particular emphasis on the demand information collected.
4. Design of suitable methodology for forecasting NHBS demand, and preparation of recommendations regarding the types of demand information that should be collected, if possible, during the planned Canadian field trials.
5. Some preliminary estimate of the relative importance of Business Services versus Home Services, over the 10 year time frame 1980-1990.

All of these tasks are covered in the report--some, to be sure, to considerably greater depth than perhaps was initially envisioned. The reader will note, however, that the study is not organized strictly in accordance with the task outline given above. Rather, we progress from a logical sequence of 'new service possibilities'--i.e., the context of the study--through the introduction, description and analysis of a range of methodological approaches to the demand assessment process, through a considerable discussion on field trials themselves and on specific examples of such trials taken from British and European experience, to, finally, our recommendations as to how demand study activities in Canada, based on both field trial and non-field trial approaches, might best be carried out.

ORGANIZATION OF THE REPORT

The report is organized in three major parts and four appendices. Part A, Context and Methodology, includes two chapters designed to introduce the subject, first from the standpoint of the range of service possibilities that are at issue (Chapter 2) and, second, the range of methodological approaches to be considered (Chapter 3).

Part B of the report (Discussion, Analysis, and Experience to Date) contains the bulk of the research. In it, each of the methodologies introduced in Chapter 3 is discussed in more detail, with examples drawn from past research as appropriate. Chapter 4 covers the wide range of non-field trial methods available for demand research studies, while Chapters 5 and 6 devote attention to field trials, both from the standpoint of generalized experience with such trials (Chapter 5), and the specific case of videotex and teletext trials in Europe (Chapter 6).

The last part of the report (Part C) contains two chapters on methodological approaches to a demand research programme in Canada, again developed generally along the lines of non-field trial (Chapter 7) and field trial (Chapter 8) methods. Here, however, attention is also paid to the 'linking' of the various methods and techniques, and thus to an overall programme plan that includes use of the various methods as research 'modules' that can be funded either separately or as research 'packages' to accomplish different objectives.

Appendix A to the report should also be noted here, as it specifically addresses one of the five tasks listed above, namely Task 5--a preliminary assessment of the relative importance of business versus home service. The reader will note that this part of the report represents an example of our apparently greater attention to videotex and teletext problems. Again, however, it should be noted that the discussion is not intended to exclude other services, but that the question of business versus home use of videotex services in general and Telidon in particular was of greatest importance in this particular task.

PART A

CONTEXT AND METHODOLOGY

Chapter 2

NEW SERVICE POSSIBILITIES

THE RANGE OF POSSIBILITIES

We are concerned in this report with essentially all new kinds of telecommunication services that might be provided in the home and in business. In the residence market for example the range of new possibilities and capabilities includes all kinds of potential services, from remote fire and burglar alarm systems, to pay television and other selective broadcast entertainment activities, electronic mail and message systems, transaction services of various types (such as, for example, "pay by phone")--as well, of course, as Telidon and other videotex and teletext systems and services. Many of these capabilities are now being actively pursued by cable, telephone, and to some extent broadcast interests, representing as they do, new potential for enhanced telecommunications in the home. We are thus concerned with all of them, for the development of one set of activities is likely to, and very probably will, influence the development of other sets of services.

On the business side, similar statements can be made. Telecommunications developments in this sector, however, are far more highly developed, more complex, and cover a much wider range of service initiatives--teleconferencing, 'Office of the Future,' facsimile, communicating word processors, electronic mail, and all the other current popular terms being but a few examples.

In this section we describe briefly some of these possibilities. First, however, it must be pointed out that there are many ways to go about this task, some of which are highly structured and formalized (such as developing a 'taxonomy' of new services and capabilities), and others of which are clearly more informal methods. We have chosen to seek what may be called a middle ground in this matter, i.e., not selecting a rigorous, structured, and all-inclusive approach, but nevertheless attempting to be reasonably comprehensive, principally by example.

PAST RESEARCH - THE SRI STUDY

For many years, long lists of services that could develop by applying computer and communication techniques, taken together, have been drawn up. One of the early lists of this type was constructed some nine years ago by one of the authors of this report. (Hough, et al., 1970). This list, which is reproduced for reference in Appendix B, contained some 400 voice, video, 'written,' and data communication services which could be offered in the future. Most of these services, as may be noticed from a perusal of the list, were primarily directed toward business applications. On the other hand, many of them, especially under the categories of library service,

education, banking, personal and institutional services, and especially the category entitled "home communications" could also be offered with suitable systems and equipment in the home.

It may be useful to note a descriptive paragraph in this almost 'decade-old' report, which reads as follows:

While it is clearly not possible to list all known or foreseeable applications of computers and communications in the next decade, SRI has, during this study, performed a search of a large number of literature sources in order to accumulate and identify many of the possibilities. It is clear that this list will represent eventually only a portion of the applications that actually come into being. Furthermore, many of the services listed here may never be established [emphasis added]. Thus, the tabulation should be considered only as a list of possible services, with the probability of establishment left undefined.

In retrospect, what has happened since this report was published is that a great many of the business applications have been implemented in virtually all industrial categories, but virtually none of the home ones have been as yet, with the exception of "home protection," and a few transaction services in the banking field (by telephone). On the other hand, neither pay television nor information retrieval services of the videotex type were specifically identified in this list, leading to the obvious conclusion that a very large number of service opportunities are still to be exploited, including virtually all those in education, home shopping, other banking transactions, home message sending, and a vast array of others.

Since this report was written, other attempts at identifying and classifying potential new services have been made, including those by Baran (1975), Bedford (1976), Communications Studies and Planning (1977), and others. In the next section we discuss briefly one of these other approaches, followed by a scheme designed to assist in the service identification and classification problem.

THE BARAN/LIPINSKI STUDY

The Baran/Lipinski study, like the SRI research mentioned above, was conducted in 1970. It was a very large study, conducted at the Institute for the Future (ITF), and sponsored by American Telephone and Telegraph Company at a cost of some \$250,000.

The method used in the Baran/Lipinski study was the Delphi technique, about which we will have more to say later. Unfortunately, we have reason to believe that this technique is not especially useful for forecasting the development of new services. Nevertheless, there are important outcomes of the IFTF study that are useful to review here, not least of which is their construction of a list of potential services.

As with the SRI work, comprehensiveness was not an important issue to Baran and Lipinski. Instead, what mattered was that a list of 'sensible' services could be constructed (to the best of their ability to determine 'sensible'), and that these services could be presented in a manner that Delphi panelists could understand and respond to them. Clearly therefore the mechanism for constructing the list was a subjective one, just as it was for the list developed at SRI.

Another aspect concerning the procedure of developing a list of services is important also in the context of the IFTF project. Because it was to be a Delphi study (in which respondents would be asked questions on each and every service--in addition, incidentally, to a massive number of other questions), the number of services dealt with had to be restricted to at least a manageable figure. In the Baran/Lipinski study this number turned out to be thirty; however, it should be recognized that that value had no relation at all to how many other kinds of services, not represented on the list, might be possible in the future.

We have stated that the IFTF work was accomplished in 1970. It was, of course, reported on at that time; some five years later, however, Baran reported on the results again, and added an additional article describing how nothing had happened in the interim, and suggesting reasons why that was the case. (Baran, 1975).

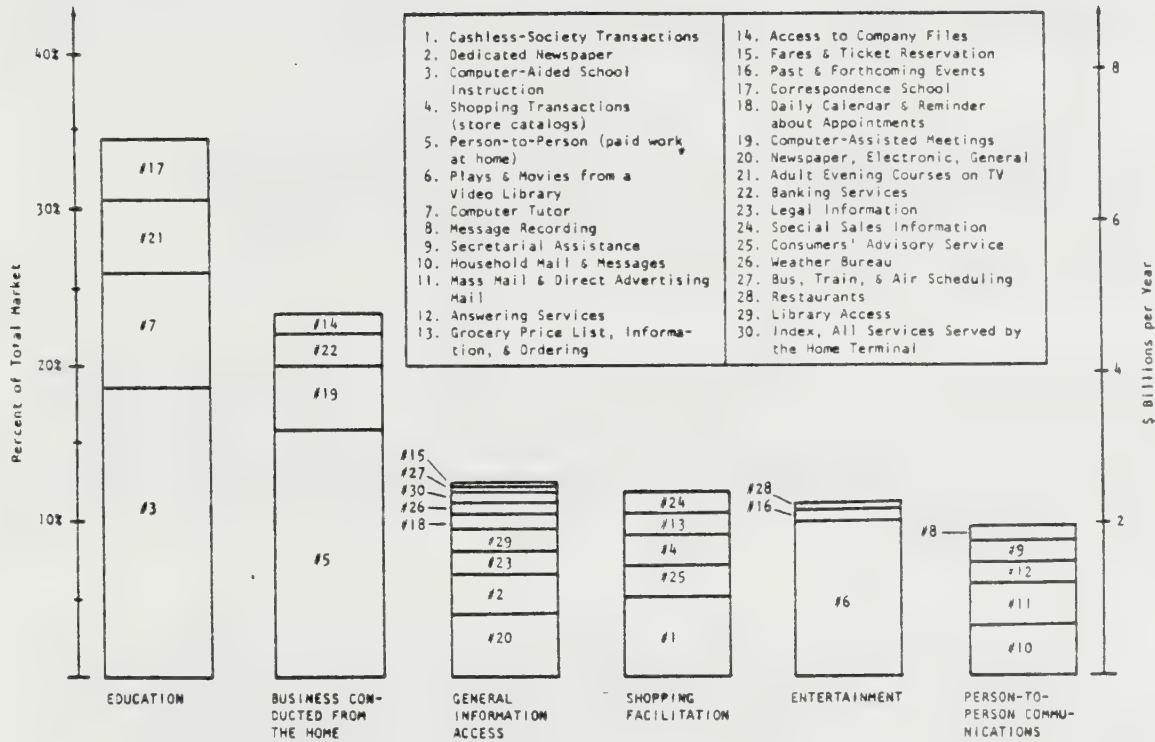
The first of these two articles constitutes the principal basis for our discussion, particularly with respect to the list of services developed and the categorization scheme used to report the results. Exhibit 2-1 lays out the basic data, that is, brief descriptions of the services as they were used in the study. From this list it can be seen that certain reasonably natural groupings occur, for example, 'education,' 'entertainment,' 'general information,' and so on.

To report the results, Baran constructed six such categories, and placed each service in its most appropriate group. Using this structure, total market sizes were estimated for each category, and ratios to total market were computed. (Market estimates were developed for each individual service from the responses of the panelists.) These results are displayed in Exhibit 2-2.

BRIEF DESCRIPTIONS OF POTENTIAL HOME INFORMATION SERVICES

1. CASHLESS-SOCIETY TRANSACTIONS. Recording of any financial transactions with a hard copy output to buyer and seller, a permanent record and updating of balance in computer memory.
2. DEDICATED NEWSPAPER. A set of pages with printed and graphic information, possibly including photographs, the organization of which has been predetermined by the user to suit his preferences.
3. COMPUTER-AIDED SCHOOL INSTRUCTION. At the very minimum, the computer determines the day's assignment for each pupil and, at the end of the day, receives the day's progress report. At its most complex, such a service would use a real-time, interactive video color display with voice input and output and an appropriate program suited to each pupil's progress and temperament.
4. SHOPPING TRANSACTIONS (STORE CATALOGS). Interactive programs, perhaps video-assisted, which describe or show goods at request of the buyer, advise him of the price, location, delivery time, etc.
5. PERSON-TO-PERSON (PAID WORK AT HOME). Switched video and facsimile service substituting for normal day's contacts of a middle class managerial personnel where daily contacts are of mostly routine nature. May also apply to contacts with the public of the receptionist, doctor, or his assistant.
6. PLAYS AND MOVIES FROM A VIDEO LIBRARY. Selection of all plays and movies. Color and good sound are required.
7. COMPUTER TUTOR. From a library of self-help programs available, a computer, in an interactive mode, will coach the pupil (typically adult) in the chosen subject.
8. MESSAGE RECALLING. Probably of currently available type, but may include video memory (a patient showing doctor the rash he has developed).
9. SECRETARIAL ASSISTANCE. Written or dictated letters can be typed by a remotely situated secretary.
10. HOUSEHOLD MAIL AND MESSAGES. Letters and notes transmitted directly to or from the house by means of home facsimile machines.
11. MASS MAIL AND DIRECT ADVERTISING MAIL. Higher output, larger-sized pages, color output may be necessary to attract the attention of the recipient -- otherwise similar to item 10, above.
12. ANSWERING SERVICES. Stored incoming messages or notes whom to call -- possibly computer logic recognizing emergency situation and diverting the call.
13. GROCERY PRICE LIST, INFORMATION, AND ORDERING. Grocery price list is used as an example of up-to-the-minute, updated information about perishable foodstuffs. Video color display may be needed to examine selected merchandise, ordering follows.
14. ACCESS TO COMPANY FILES. Information in files is coded for security; regularly updated files are available with cross-references indicating the code where more detailed information is stored. Synthesizers also may be available.
15. FARES AND TICKET RESERVATION. As provided by travel agencies now but more comprehensive and faster. Cheapest rates, information regarding the differences between carriers with respect to service, meals, etc., may be available.
16. PAST AND FORTHCOMING EVENTS. Events, dates of events, and their brief description, short previews of future theater plays, and recordings of past events.
17. CORRELATION SCHOOL. Taped or live high school, university, and vocational courses available on request with an option to either adult or graduate. Course on TV, paper support on facsimile.
18. DAILY CALENDAR AND REMINDER ABOUT APPOINTMENTS. Pre-recorded special appointments and regularly occurring appointments stored as a programmed reminder.
19. COMPUTER-ASSISTED MEETINGS. The computer participates as a partner in a meeting, answering questions of fact, deriving correlations, and extrapolating trends.
20. NEWSPAPER, ELECTRONIC, GENERAL. Daily newspaper, possibly printed during the night, available in time for breakfast. Special editions following major news breaks.
21. ADULT EVENING COURSES ON TV. Noninteractive, broadcast mode, live courses on TV -- wider choice of subjects than at present.
22. BANKING SERVICES. Money orders, transfers, advice.
23. LEGAL INFORMATION. Directory of lawyers, computerized legal counseling giving precedents, rulings in similar cases, describing jurisdiction of various courts and changes of successful suits in a particular area of litigation.
24. SPECIAL SALES INFORMATION. Any sales within the distance specified by the user and for items specified by him will be "flushed" onto the home display unit.
25. CONSUMERS' ADVISORY SERVICE. Equivalent of Consumer Reports, giving best buy, products rated "acceptable", etc.
26. WEATHER BUREAU. Country-wide, regional forecasts or special forecasts (farmers, fishermen), hurricane and tornado warnings similar to current special forecast service.
27. BUS, TRAIN, AND AIR SCHEDULES. Centrally available information with one number to call.
28. RESTAURANTS. Following a query for a type of restaurant (Japanese, for instance), reservations, menu, prices as shown. Displays of dishes, location of tables, may be included.
29. LIBRARY ACCESS. After an interactive "browse" with a "librarian computer" and a quotation for the cost of hard copy facsimile or a showscan video transmission, a book or a magazine is transmitted to the home.
30. INDEX, ALL SERVICES SERVED BY THE HOME TERMINAL. Includes prices or charges of the above, or available communications, etc.

EXHIBIT 2-2



Distribution of market size, by category

Source: Baran, 1975

From this exhibit, it is clear that the notion of 'grouping' is a completely subjective one, based on the subject matter represented by the title of the category and the titles (and intent) of the individual services. We refer to this because as may be recalled from the Introduction, one of the tasks in our terms of reference called for finding "homogeneous groups [of services] which may be expected to have similar demand characteristics."

We believe, in fact, that this task is a virtually impossible one, as it is stated above. For as Baran himself says (p.8),

In summary, when we talk of the Wired City we deal with a highly heterogeneous set of services [emphasis added]. Although the total market size is large, the allowable cost per transaction and the expected monthly revenue per household is low.

This argument is born out even more strongly, we believe, when it is observed that, regardless of one's attempt to group services according to a logical scheme, the market appears to completely ignore such structures. Instead, individual services within a group appear to 'take off'--such as pay television and home security services--leaving all other services in their category behind.

In summary, we believe it is impractical to attempt to group services according to expected similarities in demand, and the best we can do is essentially what Baran and Lipinski did, i.e., to suggest reasonable, logical categories on a subjective basis, and deal with demand questions therein.

A SUGGESTED PROCEDURE

Since the Baran/Lipinski work was carried out, much has, of course, happened--not least of which has been the teletext/videotex development. Interestingly enough, this kind of an activity was not included to any great degree in the IFTF study either, which emphasizes even more the difficulty of identifying new service concepts in a comprehensive way.

Nevertheless, what we suggest as a procedure to be followed in our recommended research programme (Part C) is assembly of the very broadest list possible of all services anyone 'has ever thought of,' and the breaking down of this list in much the same way IFTF did it--i.e., by logical, subjective groupings based on subject matter. It is not, of course, reasonable to suggest developing demand forecasts for hundreds of separate services. By developing the comprehensive list itself, however, it is felt that

logical groups--games, for example, or general information--will in fact easily fall out.* Moreover, on the basis of very recent evidence,+ this is in fact what is already happening with Prestel, namely that games are the biggest payoff service so far, and encyclopedic-type information is far behind.

* It should be noted, of course, that since this pilot study was intended to cover methodological approaches only, it was clearly beyond its scope to develop any kind of comprehensive list of services at this time. This task would, however, be required early in any DOC sponsored demand research programme.

+ R. Hooper, Mills and Allen Communications, Ltd. and E. Williams, Viewdata Executive, British Post Office, at seminar on Viewdata, Alternate Media Center (New York University), May 1979.

Chapter 3

SURVEY AND INTRODUCTION TO THE RANGE OF DEMAND ASSESSMENT METHODOLOGIES

The purpose of this chapter is to provide a brief introduction and overview of the principal methods and techniques of demand analysis discussed in the report. In later chapters we organize the discussion somewhat more, by grouping the methods into "alternative fundamental approaches," in order to highlight certain kinds of similarities, as well as simplify, perhaps, the methods' general characteristics.

To begin, a simple list of the names of the methods is appropriate:

- Aggregate 'transaction' models
- Delphi
- Leading edge
- Competitive/complementary analysis
- Retrospective surveys
- Traditional market research methods
- Disaggregate 'activity' models
- Field trials
- Laboratory experiments
- Traditional market forecasting based on 'supply-side' data
- Historical analogy methods
- Diffusion of innovation methods
- Hypothesized models based on assumed take-up of service by specific groups of households or businesses

At the outset, it should be made clear that this is our own list of techniques, and has not relied for its development on an extensive literature survey, with the objective of being exhaustive of all possible methods. In particular, we know that other writers--Jansch, for example, in the context of technological forecasting (Jansch, 1967)--have mentioned other techniques such as 'brainstorming'. While there are other methods, therefore, we are convinced that the list developed above is more than comprehensive for the purpose intended in this study.

We anticipate that many readers will be familiar with one or more of the techniques as they are named above. On the other hand, many methods will probably not be recognized with the names we have used, and others may perhaps not be familiar at all. Thus, a brief description of what we mean by the words is given in the paragraphs below. (It should be noted that these are introductory remarks only--additional description and discussion is given in subsequent chapters.)

- Aggregate 'Transaction' Models

The term 'transaction model' was coined in 1969 and 1970 to describe a method of viewing the subject of 'Information Transfer' in a very broad context. The study in which this occurred has already been mentioned (Hough et al, 1970), in connection with the development of lists of potential services in the future. In that same report the transaction model approach was introduced, with the following essential characteristics. First, it assumed that 'information transfer' could be described in terms of the media of information transmission, in four broad, major categories, i.e., voice, video, 'written', and 'data'. Second, it anticipated that 'transactions' within these categories could be accounted for and measured in terms of specific numbers of interactions appropriate to each category--for example, telephone calls in the voice category, letters in the written category, and data transmission interactions in the 'data' category. Third, the model assumed that, to compare the 'information transfer volume' of one category of service with another, it was quite legitimate to convert all transactions in each category to a uniform measure of some type, such that they might be summed over all transactions to a grand total of information transfer volume in each category. The measure used in the original study was 'bits per year,' but other measures will do as well (such as "letter equivalent" transactions) and have been used in subsequent studies. Finally, forecasts of transaction volumes can be obtained, principally from statistical data, to obtain estimates of the comparative value of information transfer in each major category, as well as certain subcategories, in the future.

- Delphi

The Delphi method is probably known to most readers of this report. A general description, however, is that Delphi is an 'opinion/consensus' technique in which so-called 'experts' are questioned anonymously, with written questionnaires, about subjects that may (or may not) occur in the future. Answers to these questions are processed by the study director, deriving, for example, median dates at which the respondents foresaw a particular innovation occurring in the future. The combined results are then fed back to the respondents for a

second round, and sometimes third or fourth ones if necessary, to see if a consensus of opinions can be arrived at. These then become the output of the study.

- Leading Edge*

The leading edge concept is somewhat difficult to describe in a few words. Its major philosophy, however, is based on the recognition that, in business as in many other places, a phenomenon variously referred to as Zipf's law, Pareto's law, the 80/20 rule, or some other such shorthand, applies. This notion recognizes that a few large businesses account for a very large share (80% or more, say) of total employees, sales volume, or any other variable one would care to name, in virtually all industrialized countries of the world, including, of course, Canada, the U.S., and Europe. Moreover, it is often these same companies that are motivated, and in a position, to introduce new business innovation on a wide scale--computers and data communications being two examples. This being the case, if one is interested in exploring the early stages of these kinds of innovations, it is not only highly practical but efficient and 'good sense' to investigate, in depth, the specific use innovative, 'leading edge' companies are making of the new technology under study. In the process, one can, in fact, obtain quantitative estimates of many of the variables of interest--for example, data communication traffic. With suitable models, then, these figures can be scaled up, using Zipf's law, to approximate estimates of use for a country as a whole, and additional models can be developed if necessary to describe the probable spread of the technology ('possible' or 'likely' are sometimes better words here) to other organizational entities in the country. Finally, these estimates can be aggregated if necessary over whole groups of countries, to establish requirements for a particular part of the world--if that is the objective of the study.

- Competitive/Complementary Analysis

In many situations, market estimates and forecasts are made in essence in a vacuum, i.e., without regard to the fact that,

* It may be useful to note that the leading edge concept was also developed by one of the authors of this report. This occurred prior to the undertaking of the now well-known 'Eurodata' study, in Europe. The concept, ideas, rationale, and methods of carrying out the work were described in detail in Stanford Research Institute's proposal for the Eurodata study (Stanford Research Institute, 1971). In that document, the method was called by another name, i.e. the pacesetter approach--but it was in all respects what has come to be known as the leading edge model, as we describe it above.

certainly at this stage of technological development, competing (and complementary) methods are available to accomplish most tasks. Moreover, as time goes on additional such developments are occurring. As a result, analysis of competing and complementary developments is an additional feature required in good forecasting. As we have indicated, this is not usually done, but it has been--as for example in a recent study completed for the Canada Post Office (Price Waterhouse Associates and R.W. Hough and Associates, 1977). In this study, likely growth of telephone, mail, telex, communicating word processors, electronic funds transfer transactions and others were forecast and compared, with 'shares of market' of the various service options as one output of the study. In general these kinds of studies make use of various pieces of the other techniques being described in this report, with, often, a good deal of judgement applied as to the effect of one technology or service on another. More sophisticated models, taking specifically into consideration individual behavioral choice among competing media, are described later, under the heading Disaggregate Activity Models.

- Retrospective Surveys

The retrospective survey is in our opinion a very powerful method of obtaining what may be referred to as 'cross-sectional' data. It is not sophisticated in the modeling sense, but if it is carried out properly, much very useful data can be obtained as to how new developments are introduced, what the problems are in implementing new systems, and if indeed there are factors that can be identified and generalized, having to do with use or 'non use' of a new technology or system. There may, perhaps, be many examples of such studies. We believe not, however, because they are relatively expensive in time and manpower to carry out, and it is only recently that enough 'test beds' have been in place to make such studies possible. We will mention here the three that we know about, and describe them in more detail later:

- . Leduc and Shepard (DOC and Bell Canada), "Review of Projects on Future Communications Services" (1979).
- . Elton and Carey (Alternate Media Center), "Interactive Telecommunication Systems: A Study of Implementation Problems" (in process: provisional title).
- . Hough, with Panko (Stanford Research Institute), "Teleconferencing Systems: A State-of-the-Art Survey and Preliminary Analysis" (1977).

- Traditional Market Research

In this category of methods, what we have in mind are the more or less 'traditional' techniques referred to earlier, which depend to their greatest extent on highly structured surveys

of buyer's preferences, willingness to buy, and so on. The methods are 'traditional' in the sense that they derive chiefly from highly developed and widely used methods of consumer market research, even though they have lately been applied to industrial products as well. Considerable discussion is given on these methods in later chapters.

- Disaggregate Activity Models

A 'disaggregate' activity model (which is also a 'transaction' model in a sense), is a sophisticated, highly complex approach to developing information useful for demand forecasting. It is, in fact, the most sophisticated of all the techniques we will be describing in this report, since it incorporates many of the other methods within its bounds and goes farther than that as well. We leave it to our colleagues in this project, Communications Studies and Planning, to describe and discuss the method in detail in later sections. Here it can be said, however, that the principal notion behind the technique is derived, in large part, from the development and use of 'modal choice models' in the transportation field. Such models are used extensively in that field today, and much useful work is thought to be transferrable to telecommunications. As a result, CS&P Ltd. have begun to construct such models, for teleconferencing and message traffic as examples, using sophisticated data collection techniques as to user's actual choices between media (or 'modes', to use the transportation term), gained from both small- and large-scale surveys of such choices, in real situations. These models, though still in their early stages, are continually being improved, and tested and validated as new information on actual use becomes available.

- Field Trials

The reader may wonder, perhaps, why we have identified 'field trials' as simply one of the items in the list, without calling them out separately. What we are trying to do here, however, is to simply identify various methods of research that can shed light on the demand problem, and the demand process. Field trials are obviously one of these methods, so it would be a mistake to leave them out. On the other hand, as we have mentioned earlier, field trials often do not develop the demand data we would like them to. We describe in later sections, in detail, why this is the case. At this point therefore it is necessary only to note that we will be discussing many different types of field trials, which have different names--for example, demonstration projects, field experiments, 'Test Services,' and so on. Extensive detail is given on these matters in Parts B and C of the report, and in Appendix D.

- Historical Analogy

The method of historical analogy is another technique designed to elicit knowledge about things relevant to the growth or potential growth of a new service, although as with some other methods discussed here, it cannot itself do the forecasting. In essence, it is a technique designed to elicit information on the actual growth patterns experienced in the past, by other products and services similar to the ones under study. As such, the method turns out to be one of the most powerful techniques we have found with which to establish 'bounds' for cross-checking the reasonableness of other forecasts. In addition, the tracking of growth of other services can provide insights into the detailed characteristics of typical growth curves. It has been observed, for example, that these patterns often follow the general form of a logistic or Gompertz curve, when plotted as a function of time. Similarly, new product or service growth has been observed to exhibit certain kinds of what we will term here 'novelty' effects--i.e., peaked growth near the beginning of a service, then decline for a time, then renewed take-up at a later date, perhaps one or two years (or sometimes even much more it should be noted) after original introduction of the service.

- Diffusion of Innovations

This heading, remarkable as it may seem, turns out to be very illusive in the context of forecasting and demand prediction studies. It does so not on its own merits, however, but simply within the context of the literature on innovation diffusion and the attention paid by researchers to elements other than forecasting. The particular reason for this is that emphasis in the field has come generally from sociological and marketing bases, and is qualitative as opposed to quantitative. In a typical setting, for example, researchers discuss in great detail the diffusion 'process', i.e., components such as various definitions of innovation or the term 'new' as applied to new products and services; product characteristics that influence diffusion; channels of communication; the 'social system' in which adoption and diffusion takes place; and individual purchase times. Attention in this type of research is also paid to the 'adoption process', by which individuals become aware of new products and, subsequently, make decisions to purchase or not purchase; and to attempts to profile early adopters in order that, obviously, marketers can target their products specifically to them. (See, for example, Schiffman and Kanuk, 1978).

Unfortunately, none of this is directly helpful in our present endeavours. The field does have useful concepts to offer in a qualitative sense however; thus it is included in our list of techniques, to be discussed later in that context.

- Laboratory Experiments

In brief terms, the kind of laboratory experiments we have in mind here are characterized most easily as 'behavioral studies', having to do, most often, with how people react in a controlled laboratory setting to different forms of new telecommunications systems. A great deal of this work has now been done, by the Communications Research Center of the DOC, CS&P Ltd. and its predecessor the Communications Studies Group, Chapanis at Johns Hopkins University, and others. These studies, while not contributing 'directly' to the development of demand forecasts, contribute very powerfully indirectly because they focus explicitly on the major problem in understanding how new systems grow or don't grow, namely, human behavior. In essence, laboratory studies are important because they help us establish hypotheses that can be tested in the real world, for example in field trials. Again, more will be said on these matters in later sections.

- Market Forecasting with 'Supplier' Data

It may be that few readers recognize what this heading refers to. In fact, however, this method is the one that is used in virtually every 'widely publicized' forecast of "The Future Market for _____" (fill in the blank!) This may be a strong statement, but we believe wholeheartedly that it is true, because we have been involved in such work ourselves and know that that is the way it is done. Without going into detail, there is one point to be made here by way of explanation. The development of such estimates--let us say for word processing, or electronic mail, or electronic funds transfer, or data terminals, or facsimile--is dependent entirely on (a) what has already happened to date and (b) where the market forecaster thinks it is going in the future. But the 'market forecasters' we are talking about here are actually a special class of organizations--i.e., they are 'professional' forecasters who make forecasts for a living, and sell them on the open market to all comers. (Examples probably come to the reader's mind, but for clarification, and in order not to be misunderstood, we mention Frost and Sullivan, Quantum Sciences, Predicast, Dataquest, Creative Strategies, and sometimes SRI International and Arthur D. Little.) In order to do this, by far the most common way to obtain the basic data--since the method is based solely on trend extrapolation--is to obtain the collective opinions of suppliers as to the value of the market at the time the forecast is being made, and to ask them as well what their expectations are as to future market growth. The method is, then, a special form of 'Delphi' study, in which collective opinions are averaged, and forecasts made on that basis.

- Hypothesized Models Based on Assumed Take-up of Service by Specific Groups of Households or Businesses

This last category of methods may be thought to be, in a sense, a sort of catch-all for forecasting or modeling attempts that do not fall anywhere else in our list. We believe, for example, that the Hickling-Johnston approach (Hickling-Johnston, 1979) would appropriately be placed here, on the basis that, as they make clear, their analysis is not really a 'forecast', but a speculative assessment of what Telidon terminal populations and revenues would occur, if certain segments of the population purchased Telidon at specific points in time. As is well known, the end result of performing and documenting such calculations is often their transposition into what are 'interpreted' as forecasts, whether or not they were meant to be in the first place. This is not altogether a bad thing, since at least it gives a 'first round' estimate of penetration and revenue potential, which can subsequently be refined by other methods, or, in fact, by more refined calculations using the same method but less aggregated data on household expenditures, as is done later in this report. The value of any such series of calculations or models, however, should be understood as lying principally in the domain of providing checks and balances on other techniques, in much the same manner as the historical analogy method was presented above.

A BRIEF CHARACTERIZATION OF THE ALTERNATIVE APPROACHES, AND INITIAL INDICATIONS OF THEIR STRENGTHS AND WEAKNESSES

In this section, we attempt to characterize all the above techniques together, in order that they may be seen and compared as a whole. In Exhibit 3-1, we identify a number of features common to one or more of the methods. These descriptors are as follows:

- Whether the method is opinion- or observation-based
- Whether or not it uses trend extrapolation methods
- What type of model is involved (simple or complex), if any
- Usual sources of data (primary or secondary)
- Whether or not behavioral factors are explicitly considered in the process
- Very general estimates of the usual, 'practical' cost of the technique (on a scale of low, medium, high)
- Our judgement as to whether the method is applicable, either 'ever' or 'as a rule', to the problem of forecasting specifically new products and services, and finally,

EXHIBIT 3-1 - INITIAL COMPARISON OF DEMAND ASSESSMENT METHODOLOGIES

	Opinion-based	Observation-based	Trend Extrapolation Used	Simple Model	Mathematical Model	Primary Data	Secondary Data	Behavioral Aspects Explicitly Addressed	Cost	Usable for new products and services	Type of research required*
Aggregate 'Transaction' Approach		x	x	x			x		L	to some extent	desk
Delphi	x					x			L-M	no	field "1"
Leading Edge		x	x			x			L-M	in modified form	field "1"
Competitive/Complementary Analysis		x		x					L	yes	desk
Retrospective Surveys		x		x		x	x		M	yes	desk
Traditional Market Research				x		x			L-H	not usually but can be made so	field "2"
Disaggregate 'Activity' Models	x										
Field Trials		x			x	x		x	H	yes	field "3"
Laboratory Experiments		x		x		x		sometimes	HH	yes	field "4"
'Supply-Push' Extrapolation		x						x	L-M	yes	laboratory
Historical Analogy	x-----x	-----x	x			x-----x	x		M	to some extent	field "1"
Diffusion of Innovation		x	x				x		L	yes	desk
Hypothesized 'Take-up' Models		x		x			x	x	L	to some extent	desk
									L	yes	desk

* Field "1," "2," etc. are notations reflecting in a very general way the level of "extensiveness" of field activities for these methodologies, on a scale from 1 (least extensive) to 4 (most extensive).

- What type of research is generally required for the method, i.e., 'desk', 'field', or 'laboratory'.

From this exhibit, one of the most important factors to be considered in our judgement is which methods are 'opinion-based' and which are 'observation-based'. As may be seen, three methods in particular derive most of their basic data from opinions, i.e., the Delphi technique, conventional market research methods, and, to some extent at least, market surveys based on 'supply-side' data. It should be recognized that calling these techniques out separately is not meant to imply that they are not useful at all. The reader will grasp, however, the authors' conviction that there are limitations to these methods because they are based on opinion rather than factual information. In Delphi studies for example reliance is placed on an assumption that the experts being polled as part of the Delphi panel are sufficiently conversant with appropriate factual information pertaining to each question, that they can in fact respond with reliable answers. As we will show, this is not always the case, leading often to collective answers that are not only difficult to interpret but difficult to validate as well. Similarly, opinion surveys concerning new products and services which use conventional market research techniques present respondents with questions to which they cannot really respond, because they don't know the answers, but to which they are inclined to give answers anyway, not wanting to be looked upon as unknowledgable.

These matters are dealt with in more detail in subsequent chapters of the report. Suffice it to say here, therefore, that the aspect of opinion vs. observation is an important one, and will guide to a fairly large extent our conclusions as to 'useful' as opposed to 'not so useful' techniques.

Several other aspects of Exhibit 3-1 should also be mentioned; notably cost (and consequently difficulty and complexity) and whether or not the technique is suitable for dealing with really new products and services. In the first category, it will be noticed that there is a wide variation in the cost and complexity of the various techniques involved. At the high end, of course, are field trials--these research settings are very expensive generally, (noted by "HH" in the cost column) because they require purchase (by someone) of an entire range of hardware components and systems, from terminals, to computers, to software and 'serviceware' in addition to all the research components themselves. Sometimes, of course, costs for large scale trials are spread over a number of groups of participants, as in the Prestel Test Service in the UK which we describe in some detail later. In other cases, field trials are much more limited in scope and objectives, and are thus funded largely by a single entity such as a telephone administration or manufacturer.

In any of these cases, however, it is reasonable to assume that field trials are at least one of the most expensive ways of conducting

demand studies, and, as we will demonstrate, this is especially the case if the trial is properly designed to do so. The major element that we wish to call attention to therefore, is the fact that considerably less expensive methods are available to assist in the demand assessment process.

Finally, Exhibit 3-1 also indicates that there is considerable diversity among the methods as to their ability to deal successfully with specifically 'new' products and services. In many respects this characteristic correlates with whether the method in question is opinion- or observation-based. Other elements also come into this judgement, however, such as whether the method can be altered or applied in such a way as to make it more amenable to new services than it might be otherwise. Conventional market research is a case in point, in that the techniques of market research are highly appropriate to our specific endeavours (the mechanisms of questionnaire design for example) although the common application of those techniques in the 'market research tradition' is not generally applicable.

In summary, the range of methods above covers a wide group, from simple to complex, 'useful' to 'not so useful', and relatively inexpensive to very expensive. It would be helpful to assume that as one spent more money, the answers would get more and more accurate. Unfortunately, this is not necessarily true; however, it can be made so by appropriate design-- i.e., by considering demand questions prior to, as well as during and after field trials, and by appropriate use of a range of methods specifically selected to provide comparative and complementary results. Parts B and C of the report illustrate how this can (and in our opinion should) be done.

PART B

DISCUSSION, ANALYSIS, AND EXPERIENCE TO DATE

Chapter 4

EVIDENCE FROM THE RESEARCH TO DATE - SURVEY AND MODELING METHODS

INTRODUCTION

In this chapter, which will prove to be the most extensive one of the report, we describe in considerable detail the development and use of the methods and techniques introduced in Chapter 3. In order to do this most efficiently, we have grouped the methods into at least somewhat homogeneous categories. Even doing this, the reader will note, is somewhat arbitrary and artificial in certain cases, since there is a wide variation in the methods across virtually any categorization scheme, as illustrated above in Exhibit 3-1. Nevertheless, it is worthwhile to discuss the methods in a structure that brings out certain kinds of similarities. The grouping to be used is as follows:

- Opinion/consensus methods (Delphi only in this case).
- Extrapolation-based approaches (i.e., historical analogy, aggregate transaction models, leading edge, and 'supply-push' extrapolation).
- Other 'desk-based' modeling and analysis methods (competitive/complementary analysis, 'hypothesized' take-up models, and diffusion of innovation methods).
- Experimental/trial-based approaches (field trials, laboratory experiments, and retrospective surveys of field-trial experience).
- Conventional market-survey methods.
- Demand modeling based on the 'disaggregate' activity model approach.

In this chapter we discuss all of the above approaches except field trials, which have been called out for separate treatment in Chapters 5 and 6.

OPINION/CONSENSUS METHODS: THE DELPHI APPROACH

The Delphi technique was developed in about 1963 or 1964, principally by Helmer, Dalkey, and others at the RAND Corporation in California (Helmer, 1967; Dalkey, 1969). This organization was at the time a 'think-tank' set up and exclusively funded by the U.S. Air Force for research into broad technical, operational and methodological problems faced by that service, both currently and, more particularly, in the future. As a result of these responsibilities, studies of the future were

of prime interest. For example, it was also at RAND where extremely important futures work involving 'scenario writing' was developed and exploited, principally by Herman Kahn and others, and moreover, where research into new technical means of communication and information transmission were first developed as well.*

In outlining the principal features of the Delphi technique, Helmer and Dalkey drew attention to the fact that often it appeared that in group 'brainstorming' sessions, a few individuals seemed to dominate, and others, who often had equally valid ideas, were not heard nor able to influence the group as much as they might have in less 'peer group influence' situations. As a result, it was concluded that a new technique should be devised that would enable a group of experts to reach a consensus on a certain topic or set of topics, by first, having the experts separated from each other rather than gathered together face-to-face in a room; second, anonymous with respect to each other; and third, subjected to questioning in a repeated mode, such that answers to 'first round' questions would be fed back to participants in a summarized mode, whence they could examine their own answers and revise them if they felt necessary on the basis of what others in the group gave as their answers--again, of course, anonymously. These revised answers would then constitute a 'second round', and the process could be repeated for third and subsequent rounds if desired.

As may be seen from this description, anonymity of the participants in a Delphi study does accomplish one of the objectives outlined above, i.e., that of reducing a 'peer group pressure' effect from face-to-face contact. It has been suggested elsewhere, however, that the generally stated aim of having the group reach a 'consensus' on a topic is still likely to lead to difficulties, simply because majority opinions, regardless of their origin, are fed back to participants in the second and subsequent rounds, thus very possibly influencing certain panelists in a negative rather than positive manner. (Tyler, et al, 1977)

Whatever the case may be regarding procedural matters, however, far more serious problems exist with Delphi for demand forecasting and market studies. These problems have principally to do with two things:

1. Delphi cannot be (or perhaps better, 'rarely is') anything more nor less than an opinion polling technique--that is, it is dependent entirely on the knowledge the panelists have, collectively, of the particular subject under study (e.g., demand for new services).

* Paul Baran, for example, already mentioned in Chapter 2, was also the originator of the concept of packet switching networks, so prevalent and talked about today, as a result of his series of reports "On Distributed Communications," published at RAND in the early 1960s.

2. Very rarely, it seems, are highly knowledgeable 'technical' experts, also expert at forecasting the future. Unfortunately, however, these are the 'experts' most often used on Delphi panels.

Lest this last comment be interpreted as an uncomplementary remark about 'technical expertise,' it should also be quickly pointed out that it has yet to be shown that any particular group of people has a special corner on forecasting the future, essentially by opinion only. For example, bearing in mind the observed limitations with previous Delphi studies, at least one group of researchers (Business Planning Group at Bell Canada) chose to devise a new procedure in which teams of experts from different disciplines would interact with each other, and answers of the groups would be compared. In particular, a study on new services to the home, published in 1976, used not only researchers as members of its panels, but educators, consumerists, welfare workers, students, and housewives. (Bedford, 1976).

Unfortunately, neither this technique nor any other that we know about has helped very much to improve the forecasting ability of Delphi--except perhaps, when panelists have basic data immediately at hand, specifically having to do with each question. Since this is rarely the case, and appears to be substantially overlooked as a requirement, Delphi often fails to be as effective as it might be.

Quite obviously, what we have said here about the Delphi method is cursory and perhaps even heavy handed. What should be recognized, however, is that we are not alone in recognizing the difficulty of making the technique work well. Sackman at RAND, for example, made a list of shortcomings of Delphi as he saw them in 1974, which are reproduced below* for comparison with our own conclusions (Sackman, 1974):

- The concept of the expert is virtually meaningless in experiments dealing with complex social phenomena.
- Sole or primary reliance on expert opinion in the social sciences has long been discredited and now has no serious advocates.
- Anonymous panels chosen in unspecified ways enhance the possibilities for contaminated, elitist "expert" samples.
- There exists an uncontrolled and unknown expert halo effect in Delphi contributing to expert oversell. Collective opinion directly reinforces unaccountability for Delphi results for all concerned - the director, panelists, and users.

* Quoted from Bedford, 1976.

- Experts and non-experts consistently give indistinguishable responses in forecasting or evaluating social phenomena impacting on common values and attitudes.
- There is no explicit matching of skills required by Delphi questions against objectively measurable skills of the panelists.

In summary, while Delphi may be effective for specific, highly controlled experiments where knowledgeable people in the specific questions being asked are used, demand forecasting for new services is not one of those environments. As Sackman illustrates, neither experts nor non-experts have been shown to be effective forecasters where complex social phenomena are concerned, and that is the situation faced in studies of demand for new services.

EXTRAPOLATION-BASED APPROACHES

Extrapolation approaches, in contrast to Delphi, are based in all cases on observation rather than opinion. Of course, it is easily recognized that such approaches have also been condemned, sometimes rather severely, for their inadequacy in forecasting the future--i.e., the 'straight line projection' syndrome. We believe, however, that with judicious use of the extrapolation concept and appropriate attention to data sources--sometimes using a variety of sources if necessary--these methods can be established as very powerful indeed.

In this section we elaborate on four techniques, taken in a logical order to how they have been used in the past.

Historical Analogy

Historical analogy, as described in Chapter 3, is a technique designed to elicit information on actual growth patterns experienced in the past, by other products and services similar to the ones under study. We indicated there that the method is an especially powerful technique in providing checks and balances on other forecasting methods. In this section, we attempt to show why this is so, in addition to describing the method and its applications more fully.

Considerable use has been made of the historical analogy model in past studies, but always in the context of new business services--for example, data communications, facsimile, electronic mail and so on. The method is equally useful, however, in dealing with potential new services in the residence market. Assume, for example, that we are concerned with the development and application of Telidon or other videotex services, and wish to establish some reasonable range of upper limits on potential growth.

One way this can be done, of course, is to use a simplified model based on assumed household expenditures on Telidon-related products and services, coupled with rough estimates of the rate at which groups of households at different income levels might take up the service over time. This method, which is the basic technique used in the recent Hickling-Johnston study (Hickling-Johnston, 1979), does give estimates for penetration over time. The principal difficulty with it, however, is that there is no way to measure how 'realistic' the resulting forecasts are, and one is left with only the alternative of judging, subjectively, the reasonableness of the model's assumptions--i.e., overall average household expenditures, and the rate of service adoption as a function of income level and time.

The historical analogy method offers a way out of this dilemma. For example, if it were possible to obtain observed, statistical data on the periods of earliest growth of other new technologically advanced products and services, comparisons might be drawn between the actual growth of these services, and assumed potential growth of Telidon/videotex services.

Such data are possible to obtain, at least to a certain degree. For both Canada and the U.S. for example, statistics have been collected on the early growth of a variety of new technological developments, some of which are illustrated in Exhibits 4-1 through 4-7. From these figures it is seen that for most new services there is an early growth period during which increases come rapidly followed by periods of various length during which growth is reasonably steady and continuous but at substantially lower growth rates per year than at the beginning of introduction of the services. In some cases, of course, a product or service begins to wane completely at some point and may even decline in absolute values over time, as illustrated by the case of telegrams (Exhibit 4-8). In the more general case, however, if products and services are indeed continuing to be useful over time, rates of increase year over year will tend to decline but still at least be positive, as population, income level, standard of living and so on continue to increase.

The figures in Exhibits 4-1 to 4-8 are helpful in other ways as well. For, knowing rates of increase at the earliest stages of an innovation's life cycle can enable one to make comparisons to projected rates of increase for new, untried products and services.

This also has been accomplished for a variety of services, as shown in Exhibits 4-9 and 4-10. Here it is seen that growth rates are sometimes very large in the earliest years, but they tend to decline rapidly, and with few exceptions (notably television in both the U.S. and Canada and computers in the U.S.), exhibit average annual growth rates considerably less than 100% per year after five or so years of service.

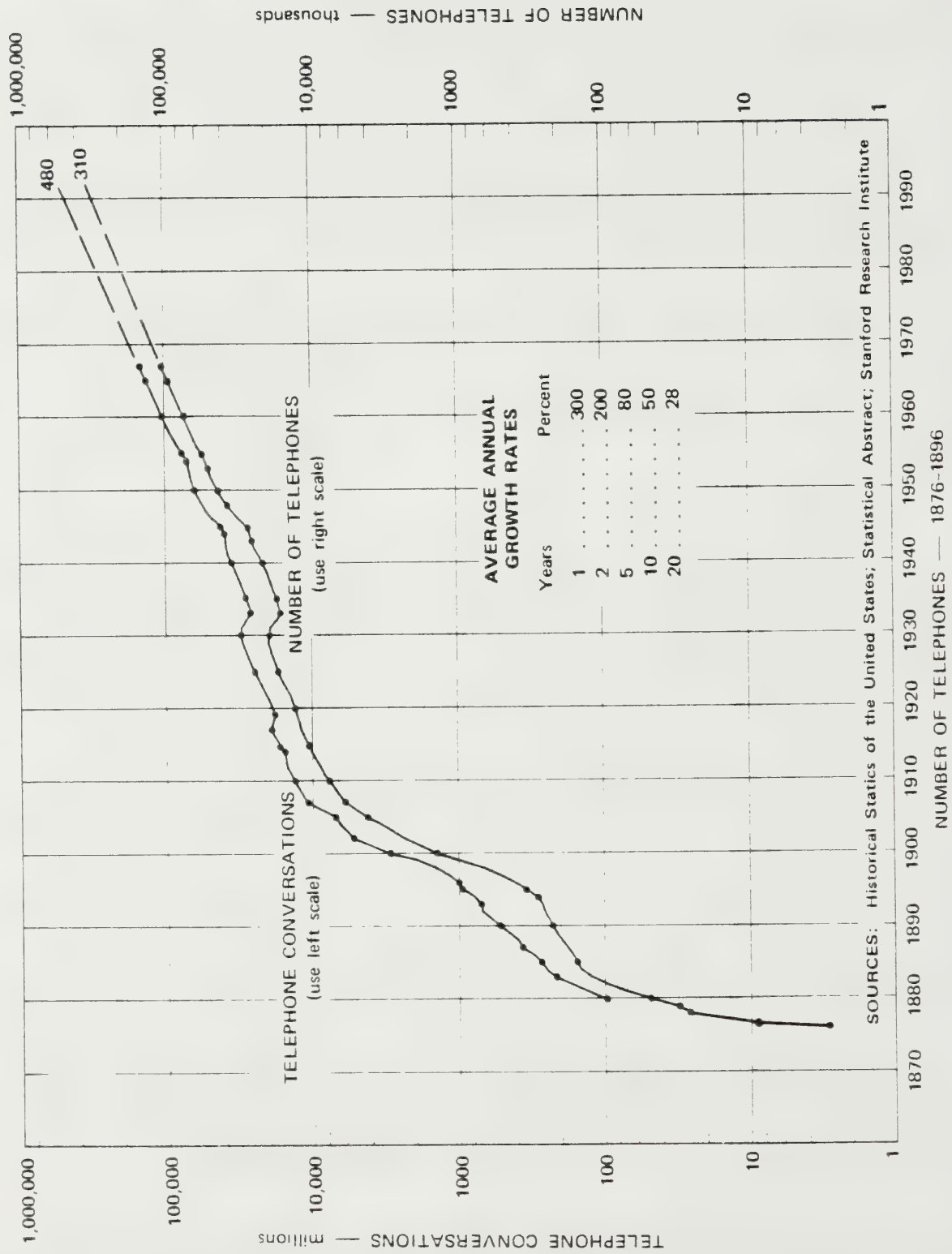


EXHIBIT 4-1 U. S. TELEPHONE GROWTH, 1876-1970

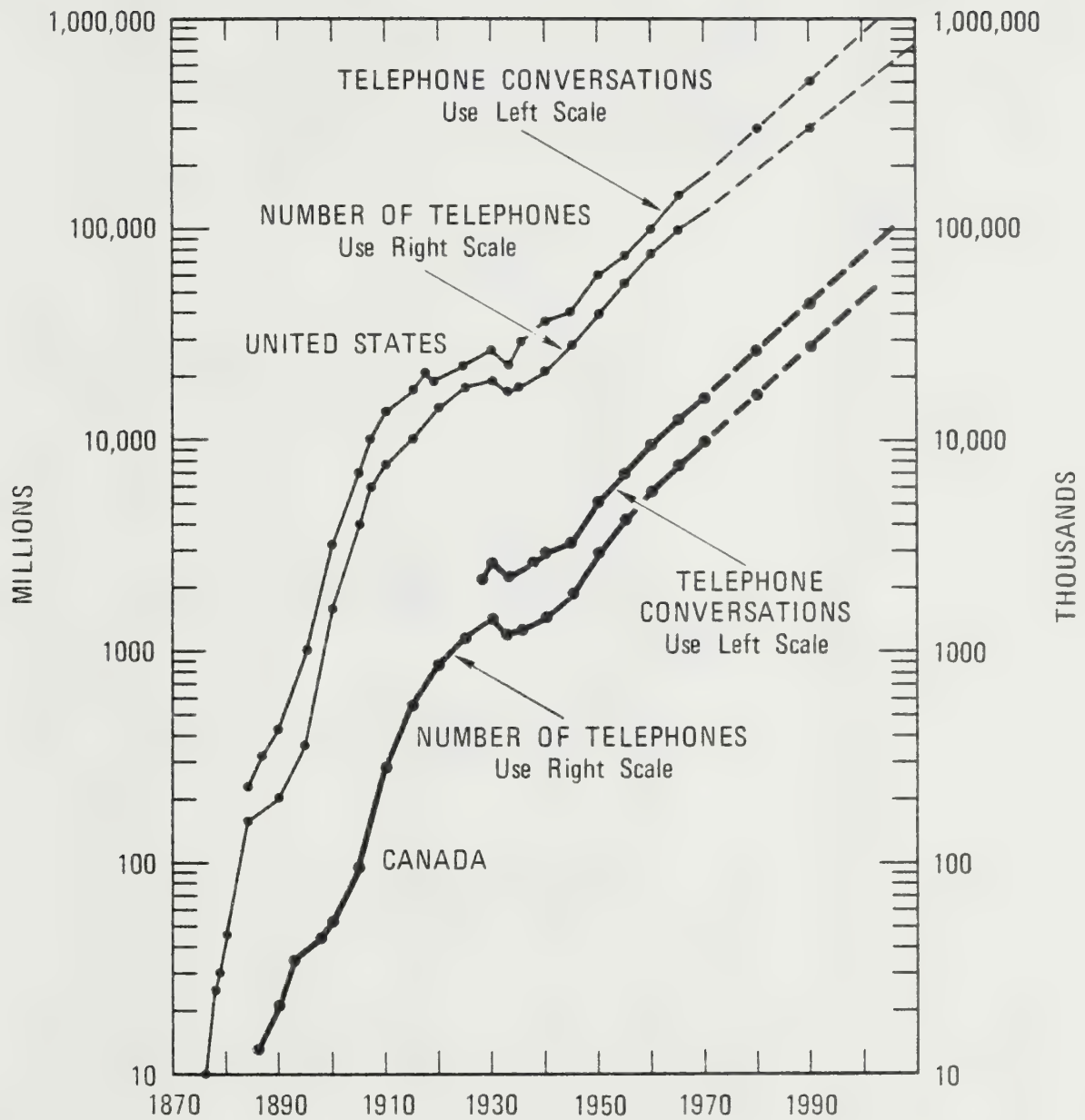


EXHIBIT 4-2 TELEPHONE GROWTH, UNITED STATES AND CANADA

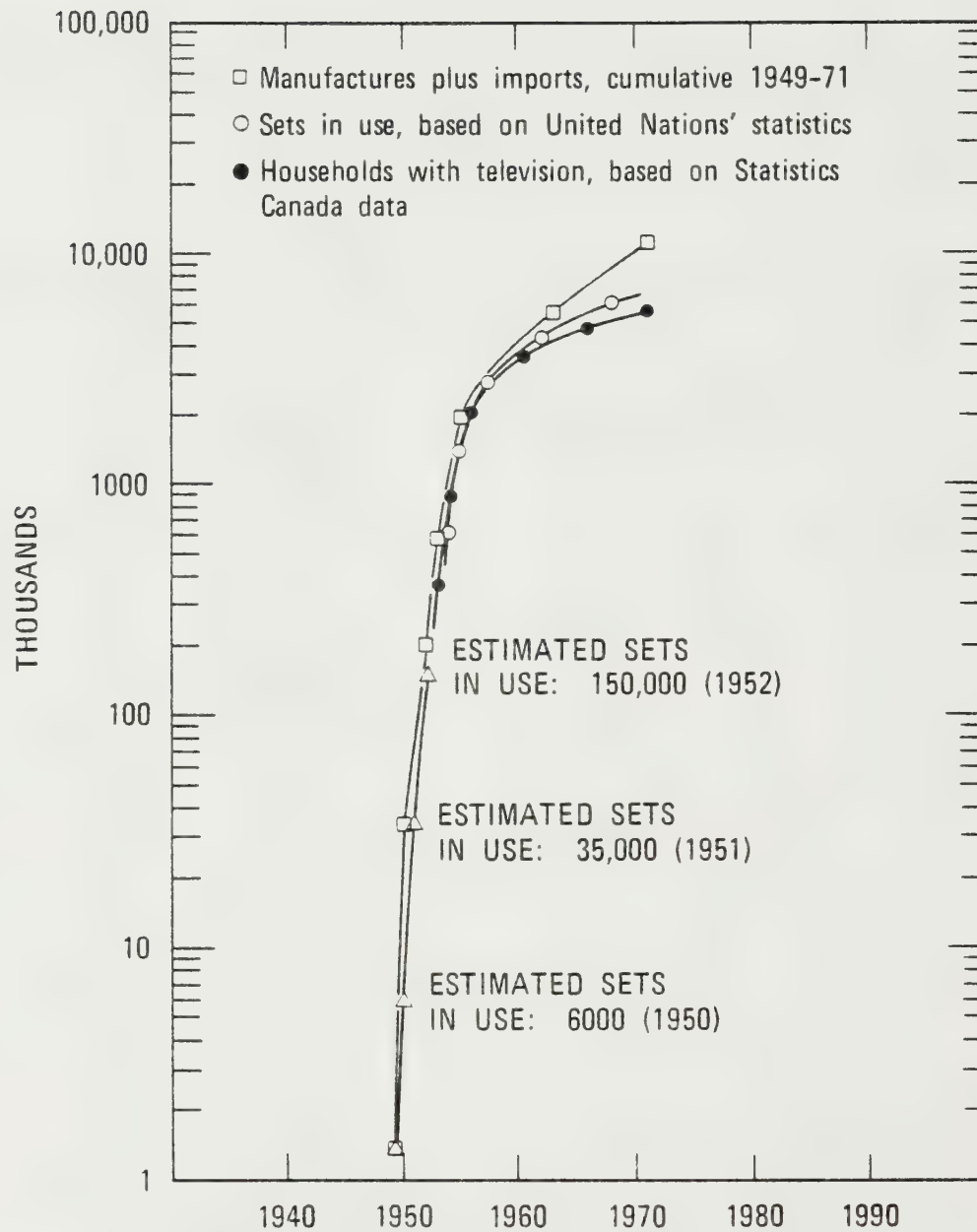


EXHIBIT 4-3 GROWTH OF TELEVISION IN CANADA

Manufactures, sets in use, and households with TV,
1949-1971.

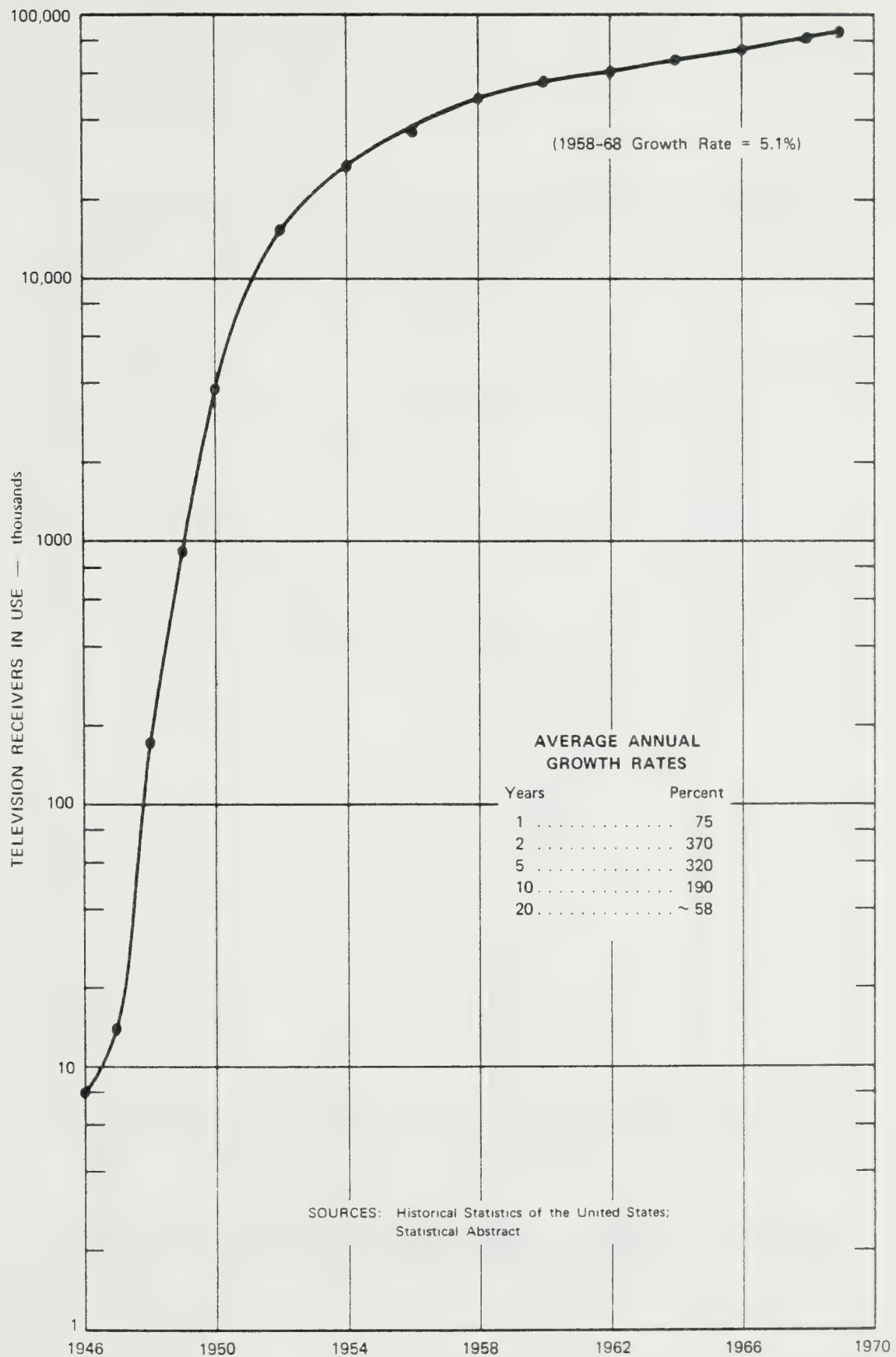


EXHIBIT 4-4 GROWTH OF TELEVISION IN THE UNITED STATES

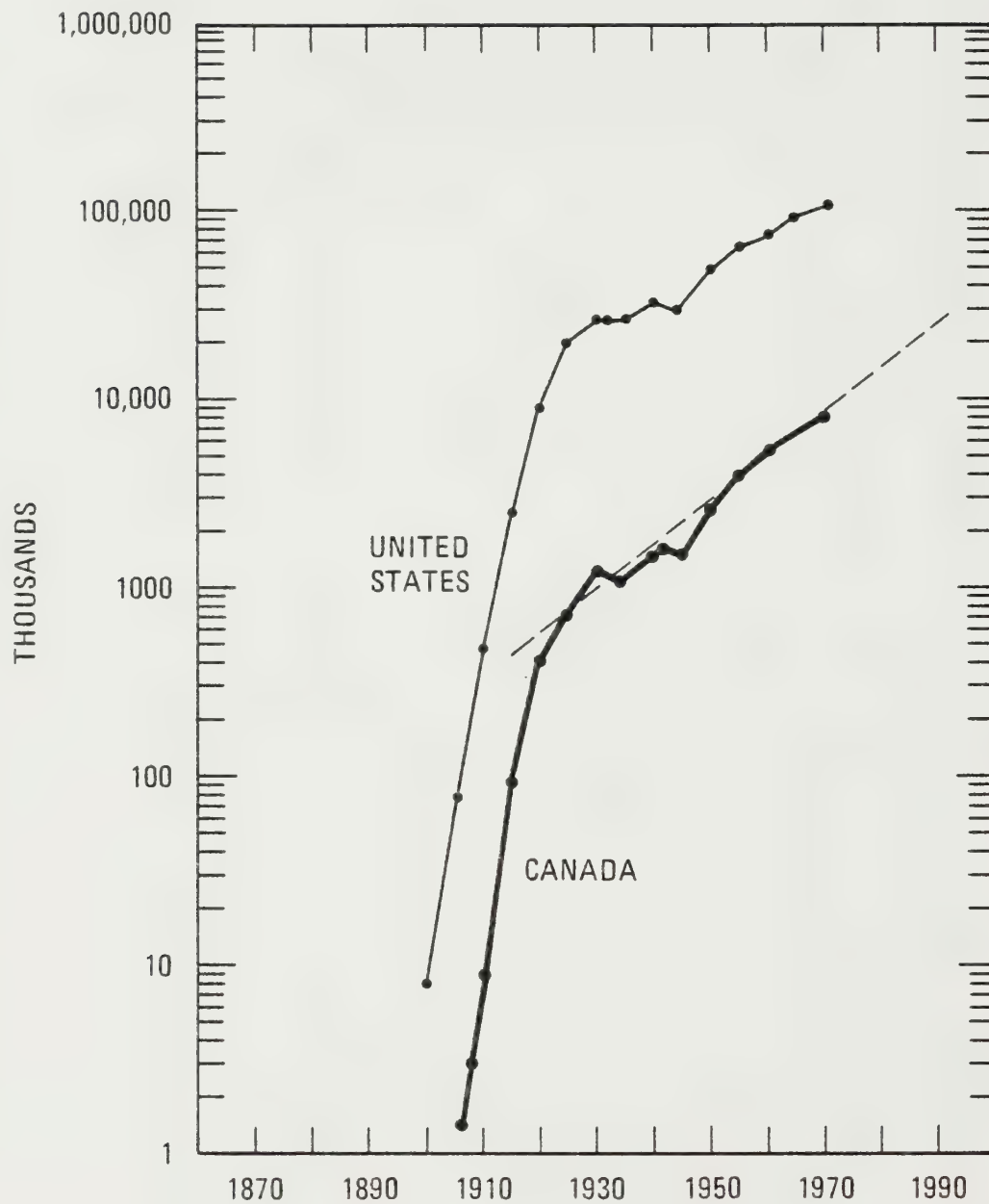


EXHIBIT 4-5 NUMBER OF MOTOR VEHICLE REGISTRATIONS,
UNITED STATES AND CANADA

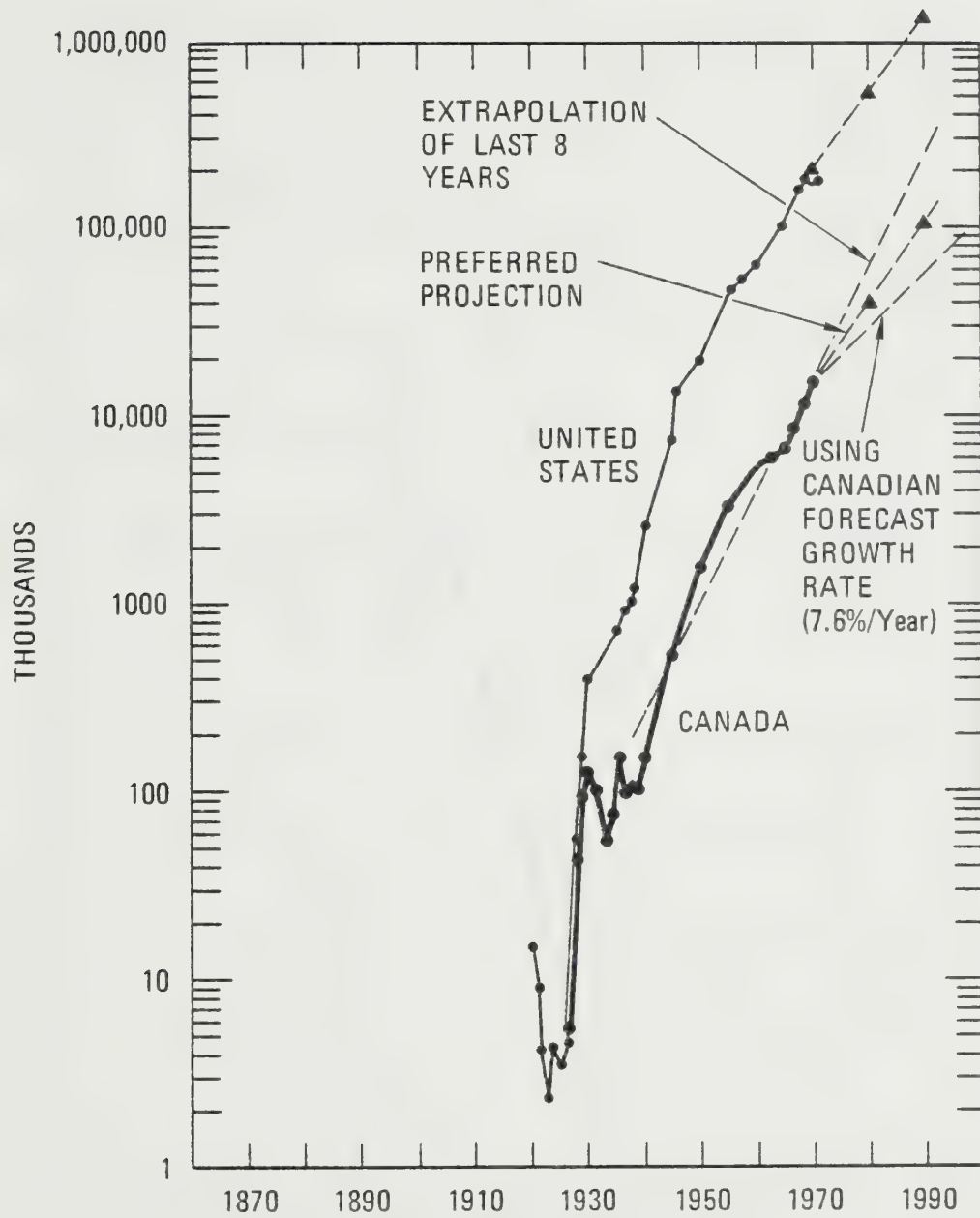


EXHIBIT 4-6 AIR PASSENGERS CARRIED, UNITED STATES AND CANADA

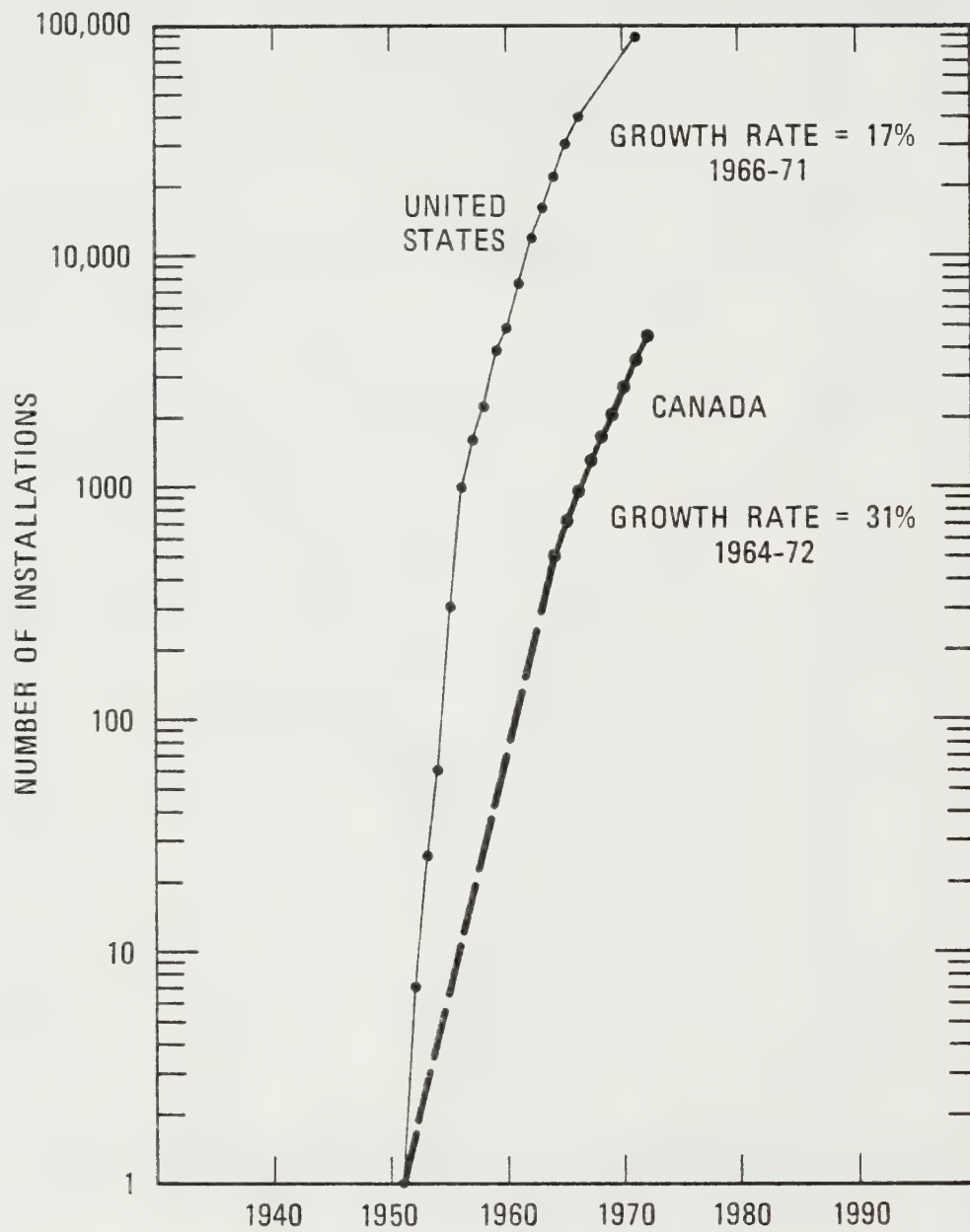


EXHIBIT 4-7 COMPUTERS INSTALLED, UNITED STATES AND CANADA

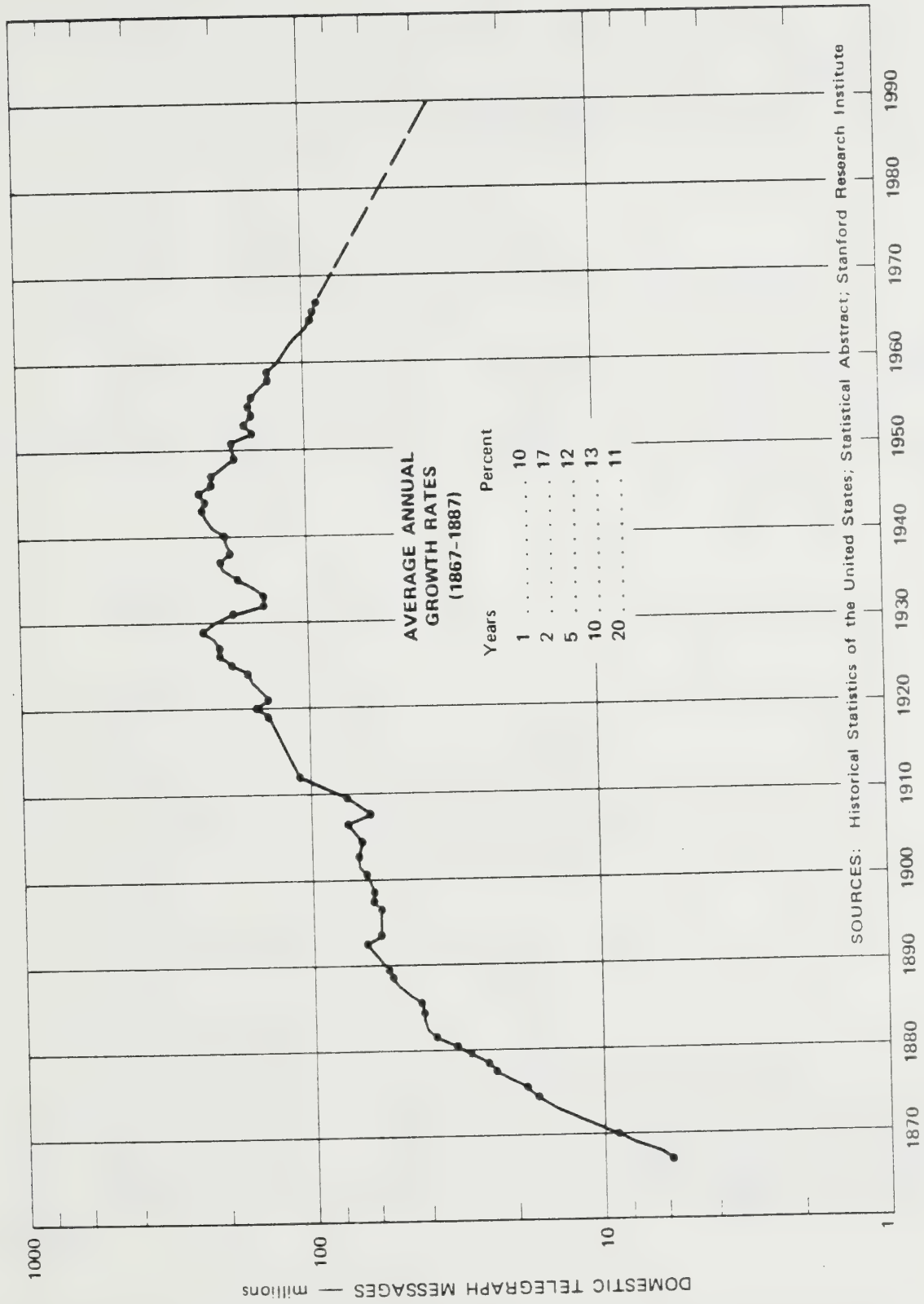


EXHIBIT 4-8 U. S. TELEGRAPH SERVICE, 1867-1970

EXHIBIT 4-9

AVERAGE ANNUAL RATES OF EARLY GROWTH OF SELECTED
TECHNOLOGICAL DEVELOPMENTS: UNITED STATES

		Growth Rate (percent)				
	<u>Years</u>	<u>First</u>	<u>First</u>	<u>First</u>	<u>First</u>	<u>First</u>
		<u>Year</u>	<u>2 Years</u>	<u>5 Years</u>	<u>10 Years</u>	<u>20 Years</u>
Telephone	1876-1896	300%	200%	80%	50%	28%
Telegraph	1867-1887	10	17	12	13	11
Television	1946-1966	75	370	320	190	58
Microwave	1948-1968	0	42	43	33	23
Automobile	1900-1920	85	70	60	50	41
Computers	1951-1971	700	400	300	210	84

EXHIBIT 4-10

AVERAGE ANNUAL RATES OF EARLY GROWTH OF SELECTED
TECHNOLOGICAL DEVELOPMENTS: CANADA

		Growth Rate (percent)				
	<u>Years</u>	<u>First</u>	<u>First</u>	<u>First</u>	<u>First</u>	<u>First</u>
		<u>Year</u>	<u>2 Years</u>	<u>5 Years</u>	<u>10 Years</u>	<u>20 Years</u>
Telephone	1886-1906	15%	11%	14%	12%	12%
Television	1949-1969	67	213	184	98	45
Automobile	1904-1924	20	68	57	65	43
Air travel	1923-1943	85	26	90	40	28
Computers	1951-1971	--	--	--	--	50

Comparing these results with projected rates of growth of Telidon/videotex becomes, then, a relatively simple exercise. Assume for example that in 1980 some 3,000 sets are in place. (Note that this corresponds, incidentally, to the number of telephones in the United States in its first year, 1876). Taking, then, the figure of 600,000 projected to be possible by Hickling-Johnston in 1986, it is easily seen that this represents a growth rate very much in excess of 100% per year averaged over six years, and therefore, in our view, is considerably more optimistic than is warranted under the circumstances.

There are other ways to validate such projections as well, which we consider in Appendix A. In general terms it may be summarized here that in each case, substantially lower figures for expected penetration are shown to be quite a bit more likely than those in the range of 300-600,000 in 1985 or 1986. This is not to say that such growth cannot happen, of course, but only that it would indeed represent something out of the ordinary in comparison with past rates of service growth.

To summarize, the historical analogy method is shown to be a very useful technique for analyzing demand assessment problems, particularly because it illustrates in convincing terms how new services have grown in the past. As we describe later in our Recommendations section (Part C), much more data are required in this area, to go beyond what is illustrated here. For example, early growth of more recent products and services are very much needed--cable television, pay television, CB radios, colour TV, pocket calculators, home computers, video games, video tape and cassette recorders, and new products and services in business being but a few examples. With these results in hand, considerably greater understanding can be developed of the potential for other new services on the horizon, including Canadian versions of some of the ones above.

Aggregate Transaction Models

We described the theory of aggregate transaction models briefly in Chapter 3. To reiterate, these models were brought into existence originally in connection with studies of information transfer in a broad sense, that is, referring to voice telephone calls, data transmission, written communications and so forth on some common basis, such that amounts of information transfer originating from these sources could be compared.

In more detail, the transaction model utilizes as a basic starting point statistical information of a similar kind to that embodied in the historical analogy method. These data are also historical figures on actual, observed services; however, they are not the early growth indicators used earlier, but rather the latest figures available

for each service. As shown in Exhibits 4-11 through 4-14, such data can be used to project, using simple trend analysis methods, at least approximate figures for growth in the future, with the proviso that at this stage in the model actual values in future years are much less important than information to be developed of a relative nature.

The second step in the development of a transaction model follows from the fact that information transfer volume is the key variable sought. On this basis, number of telephone calls is the appropriate parameter for a value representing 'voice information transfer' over the telephone networks, and, similarly, number of letters represents one measure of 'written' information transfer, while number of books and newspapers represents another component of that category.

On the data communications side a much more complex situation emerges. Here there are no statistics whatever at the aggregate level--or at any level of detail for that matter, other than what one can establish with a research project of some kind. There are other ways to make the problem tractable however, by assembling data on potential transactions. Assume for example that a 'checkless society' does indeed exist at some time in the future, say, 1990. In such a case it is reasonable to assume that, at a minimum, the equivalent number of 'transactions' represented by check volume today and projected into the future would still have to occur, and that one could reasonably add to that volume transactions from credit card purchases as well. These numbers of transactions would then (conceptually at least) take place via electronic funds transfer means in an 'all electronic world.'

The potential volume of this type of information transfer can easily be accounted for in data communications terms by estimating the number of characters or bits of information on a check or credit transaction invoice. This number is, generously, some 50 characters or 500 bits; that is, using alphanumeric coding techniques, 50 characters is entirely sufficient to encode all the information contained in a check in order to enable its transmission and processing electronically. Using this figure it is a simple matter to calculate the total volume of information transfer represented by an 'all-electronic checking service'--i.e., some 10^{14} bits per year in the U.S. and about 1/100 of that value in Canada, 10^{12} bits per year, both based on forecasts of check and credit volume to 1990. (Hough, et al, 1970, 1973).

The last step in the aggregate transaction approach is to convert all transactions to a common base and add them up. Important findings have emerged from doing this in the past, not least of which has been the fact that voice telephone calls represent not only the bulk of the information transfer market but exceed all other categories by wide margins. Other aspects are equally important, however, such as the fact that letter mail has been consistently declining in relative

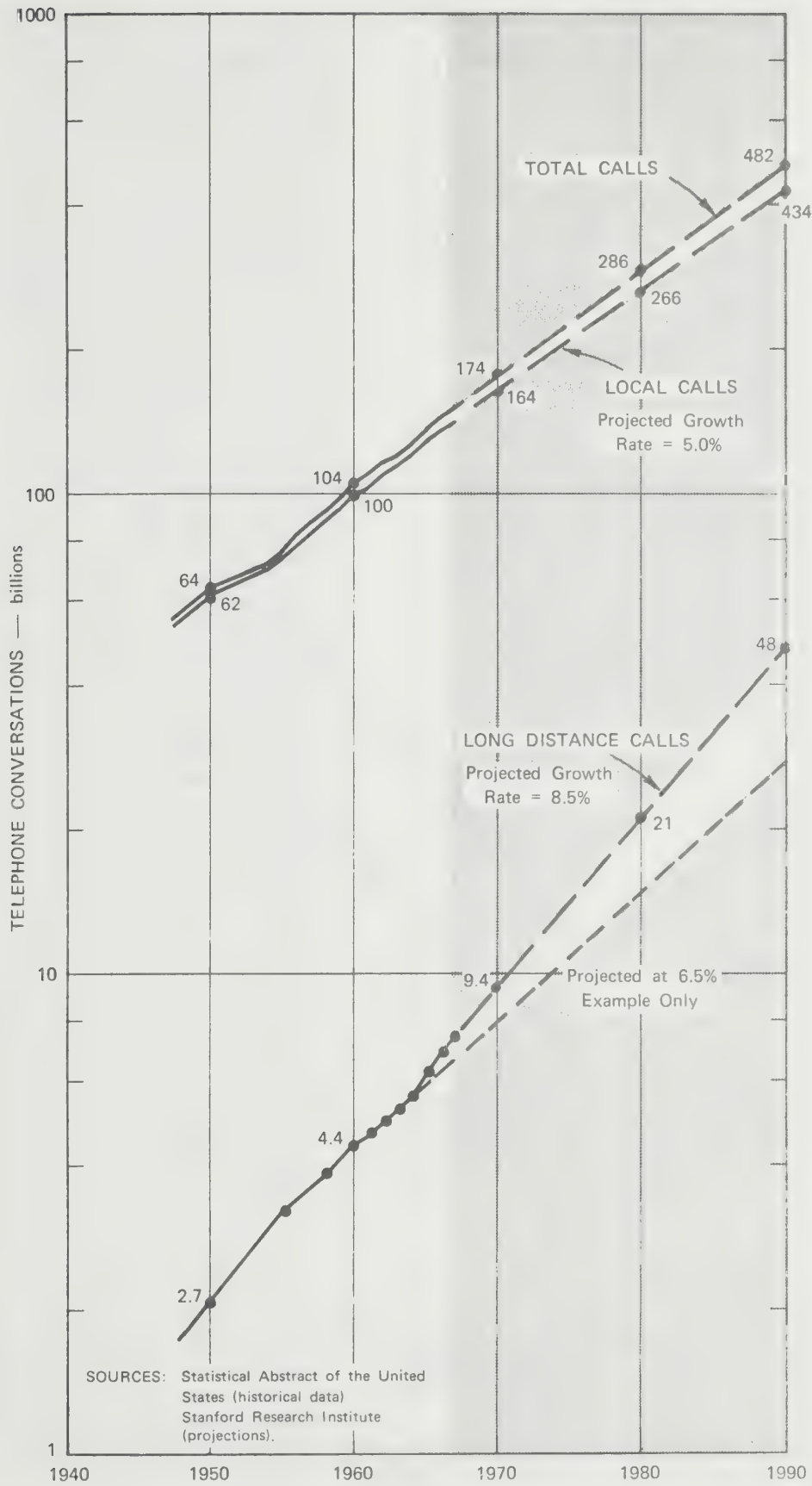


EXHIBIT 4-11 TELEPHONE SERVICE (U.S.)

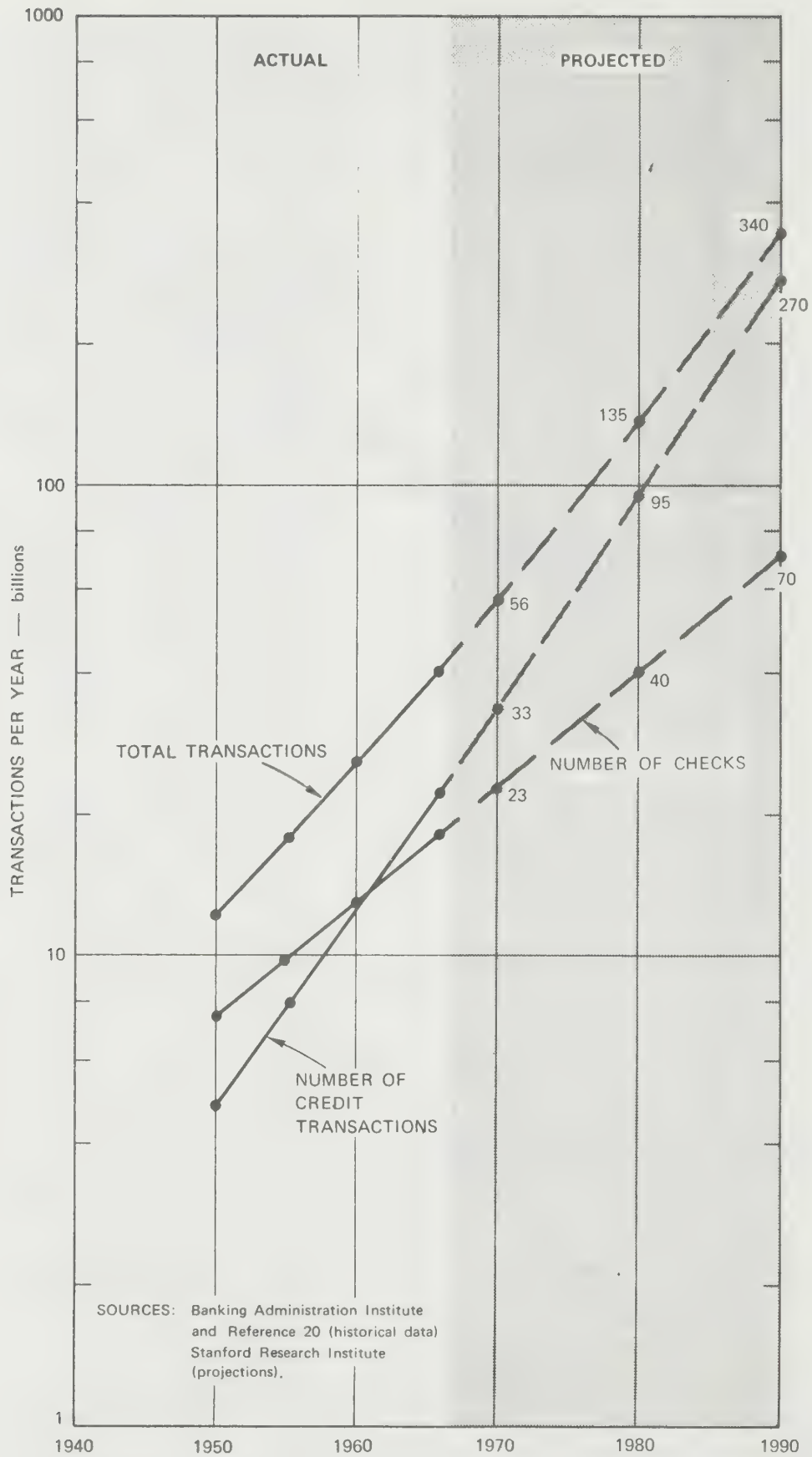


EXHIBIT 4-12 CHECK AND CREDIT TRANSACTIONS (U.S.)

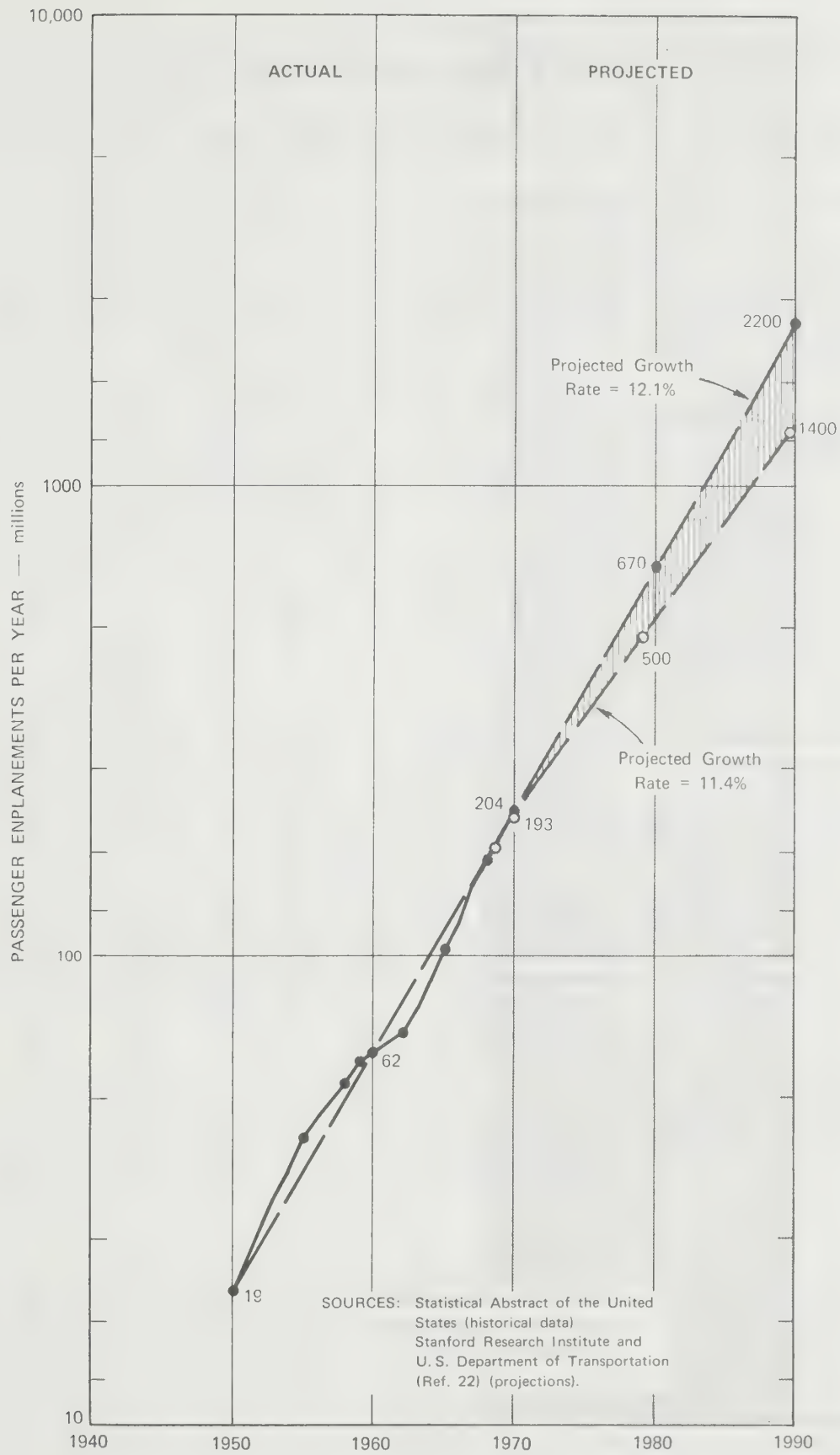


EXHIBIT 4-13 AIRLINE RESERVATION INFORMATION TREND INDICATOR (U.S.)

EXHIBIT 4-14

SUMMARY OF DEMAND TREND PROJECTIONS (U.S.)

Service	Units	1950	1960	1970	1980	1990
<u>Voice</u>						
Telephone	calls/year $\times 10^9$	62	105	174	286	482
<u>Video</u>						
Video telephone	calls/year $\times 10^6$	0	0	1	36	1,000
Television transmission	hours/year $\times 10^3$	11	11	14	32*	72*
<u>Record and Data</u>						
Telegraph	messages/year $\times 10^6$	180	125	80	53	35
Stolen vehicle information transfer	cases/year $\times 10^3$	160	320	820	1,950	4,600
Stolen property information transfer	cases/year $\times 10^3$	430	880	1,700	3,500	7,000
Facsimile transmission of "mug shots," fingerprints, and court records	cases/year $\times 10^6$	2	3.5	7	13	25
Motor vehicle registration	items/year $\times 10^6$	49	74	110	164	245
Driver's license renewal	items/year $\times 10^6$	38	48	60	75	90
Remote library browsing	accesses/year $\times 10^6$	0	0	neg.	5	20
Remote title and abstract searches	searches/year $\times 10^6$	0	0	neg.	8	20
Interlibrary loans	books/year $\times 10^6$	--	--	neg.	40	100
Remote medical diagnosis	cases/year $\times 10^6$	0	0	20	60	200
Remote medical browsing	accesses/year $\times 10^6$	0	0	20	60	200
Electrocardiogram analysis	cases/year $\times 10^6$	0	neg.	20	60	200
Patent searches	searches/year $\times 10^6$	6	6	6.5	7	7
Checks and credit transactions	transactions/year $\times 10^9$	11	25	56	135	340
Stock exchange quotations	transactions/year $\times 10^9$	0	0	1	2	4
Stock transfers	transactions/year $\times 10^6$	290	580	1,200	2,500	4,900
Airline reservations	passengers/year $\times 10^6$	19	62	193	500	1,400
Auto rental reservations	reservations/year $\times 10^6$	0	neg.	10	20	40
Hotel/motel reservations	reservations/year $\times 10^6$	--	--	25	50	100
Entertainment reservations	reservations/year $\times 10^6$	--	--	100	140	200
National Crime Information Center	transactions/year $\times 10^6$	0	0	6	20	70
National legal information center	transactions/year $\times 10^6$	0	0	neg.	5	30
<u>Written</u>						
Mail (first class and airmail)	letters/year $\times 10^9$	25	35	50	70	100
Books (remote printing)	new titles/year $\times 10^3$	11	15	34	60	105
Newspapers (facsimile transmission)	number of newspapers using service	0	1	2	10	20

* Assumes the projection to 20 networks in 1990.

importance, and will continue to do so unless means for implementing electronic mail systems are developed and find a useful place in the overall information transfer market.

From the above analysis the aggregate transaction approach is seen to be another effective and indeed even powerful tool for analyzing future demand patterns in certain circumstances. Unfortunately, for most of the potential new services to be considered in the NHBS programme, the method appears at this stage to be less useful than it has been in the past in the context of aggregate levels of information transfer demand. The reason for this, of course, is that the objective of new research is focused at more disaggregate levels--i.e., at the types of individual services (or groups of services) that may be expected to emerge in addition to or in place of telephone calls, mail, and so on. This being the case we do not recommend the immediate use of the aggregate transaction model formulation in our plan of research, but rather leave it as a tool to be called on later, if appropriate.

Leading Edge

As described earlier, the basic concept and rationale of the leading edge method is to make it possible to collect a very large amount of substantive information with a minimum of effort and expenditure by surveying leading edge or 'pace-setting' firms in the use of a new technology, to ascertain in detail their responses to that technology, by way of actual use. From this description it is seen that, like the previous two methods discussed in this section, the leading edge method relies completely on observed data, not opinions, and can thus be relied on as an excellent measurement tool for ascertaining real usage patterns of the new service under study.

In this section we describe the leading edge method somewhat more, and illustrate briefly how it has been used in the past in both Canada and Europe. The subject matter in each of these cases is data communications since it is in that area that the method appears to have had its heaviest use at this time.

At least three studies have made use of the leading edge method in Canada, and one very large study followed by subsequent smaller ones have utilized the method in Europe (Exhibit 4-15). In this report we refer briefly to each of these, while concentrating mostly on the one conducted for the Department of Communications, since more data are publicly available from that study than from the others.

While mentioning above that the fundamental original motivation for the pacesetter/leading edge concept was to reach a relatively

EXHIBIT 4-15 - EXAMPLES OF MARKET RESEARCH STUDIES OF DATA COMMUNICATIONS USAGE UTILIZING THE LEADINGEDGE METHOD OF DEMAND ASSESSMENT

Title	Sponsor	Contracting Organization	Date	Approximate Funding
Eurodata Study	European PTTs (CEPT)	PA Int'l Management Consultants/ Quantum Science Corp.	1972-73	\$1.7 million (\$U.S.)
Canadian Information Transfer Study	Trans-Canada Telephone System	Stanford Research Institute	1973	\$100,000
DATACOM 76	Canadian Department of Communications	Price Waterhouse Associates in collaboration with R.W. Hough	1976	\$100,000
International Data Communications Study	Teleglobe Canada	Woods Gordon & Co. (Logica Ltd., R.W. Peters, and Hough and Associates, sub-contractors)	1977	\$230,000

small sample of large users of the technology under study, one of the first aspects of comparison that is interesting from the four studies identified in Exhibit 4-15 is the range of sample sizes that have actually been used. For example, the study which, it appears, most closely resembles the original concept is the TCTS project. Here, it was shown to be possible to establish, even with a very small actual user base totalling in fact only 35 organizations, very credible estimates of computer communications usage on a number of different bases, including estimates of data traffic for the country as a whole, and breakouts by industrial classification, type of traffic, and geography. By contrast, the Eurodata study was conducted using a very comprehensive survey approach involving several thousand respondents, many of which turned out to be, in fact, non-users rather than users--making Eurodata much more akin to a 'traditional' market research study (see later section) than to a leading edge one.*

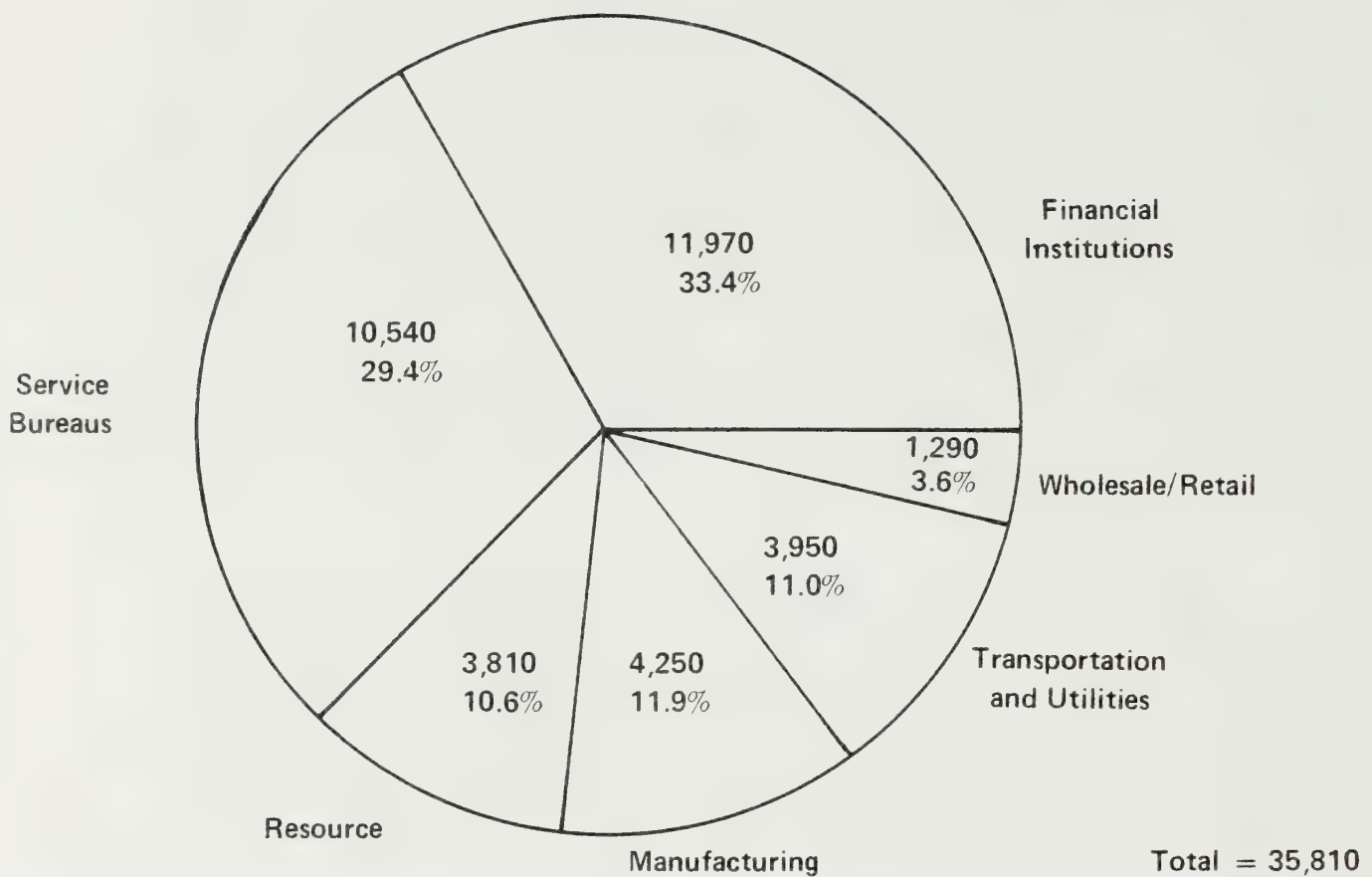
In the case of the DATACOM 76 study funded by the Research Sector of DOC, the leading edge sample size was somewhat larger than in the TCTS research project--i.e., approximately 74 respondents. Here again, however, it was found that a very impressive amount of information could be derived from these respondents that was of significant interest not only to DOC but to a wide range of other interested parties, not least of which were the telephone companies themselves. (See Price Waterhouse Associates/R.W. Hough, 1976).

In Exhibits 4-16 to 4-19 we illustrate some of the types of detailed information that can be gained from a thorough, well-conducted leading edge study. Exhibit 4-16 for example shows two sets of data, the first referring to 'printing activity' of the respondents--that is, a rough measure of the basic amount of 'throughput' represented by computer activities in the various industrial sectors and the survey sample as a whole--and the use by the respondents of four major categories of terminals, i.e., remote batch terminals, CRT display units, teletypewriter-like terminals and 'other'--notably bank teller terminals.

In Exhibit 4-17 a completely different set of data are displayed, that is, the traffic flowing in the various systems, among and between the terminals and the computer systems to which they are connected. Of note in this exhibit is the fact that the data represent only 54 companies rather than the 74 responding to the overall survey; in this case therefore it might be said that the study represented even more noticeably a 'leading edge' approach.

* Tyler, incidentally, has some interesting things to say on this subject in his excellent and very informative paper, "User Research and Demand Research: What's the Use," especially in the section, 'Does it Work? The Validity of Quantitative Models,' on p. 13. (Tyler, 1978).

EXHIBIT 4-16

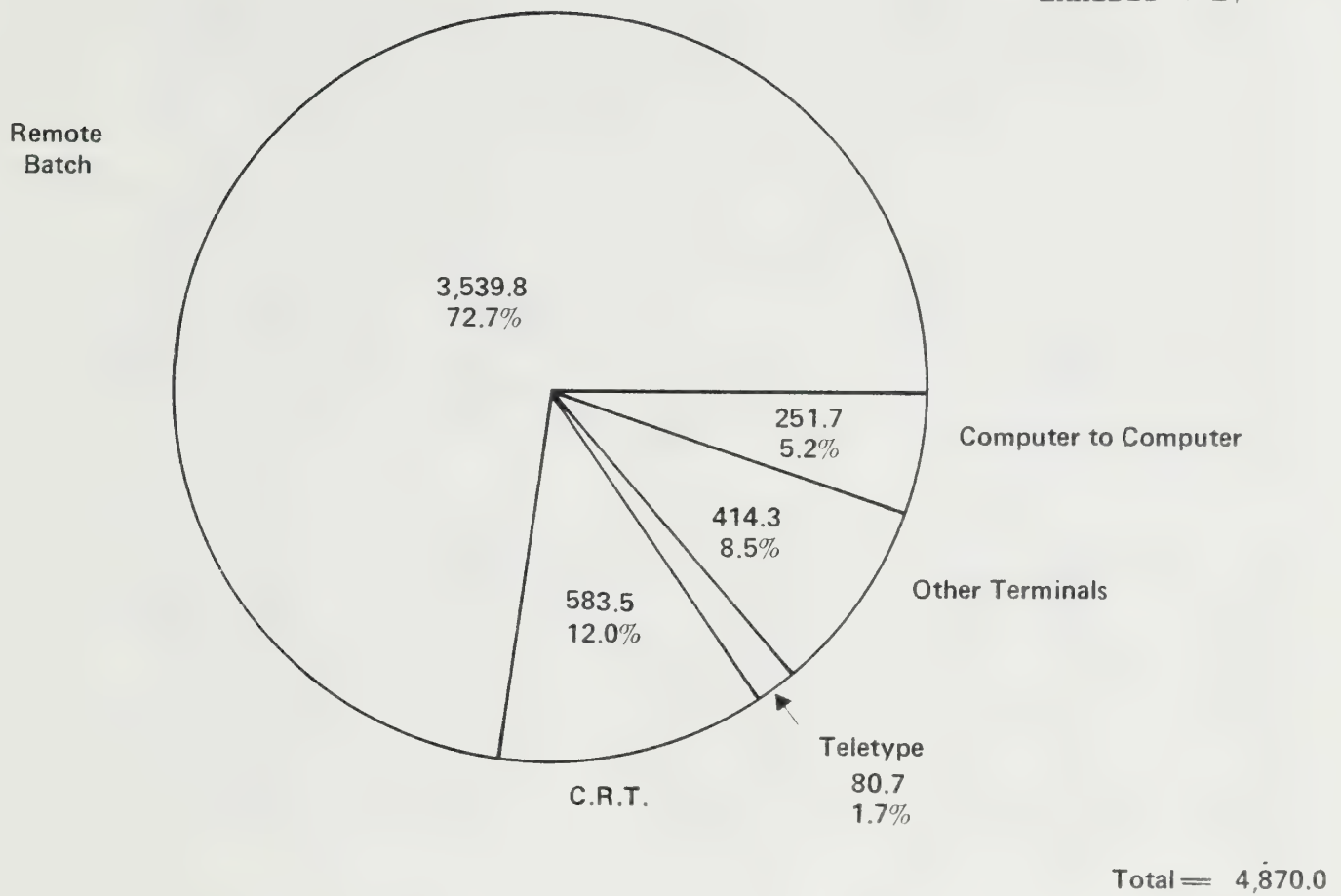


1976 Total Printing Activity by Sector for this Sample (in Millions of Lines Per Year)

	Remote Batch	Video (CRT)	TTY	Other	Total
Financial Institutions	50	549	635	8,997	10,231
Service Bureaus	580	24	1,524	—	2,128
Resource	109	50	73	104	336
Manufacturing	119	550	197	960	1,826
Transportation and Utilities	41	3,705	828	139	4,713
Wholesale/Retail	66	44	20	404	534
	<u>965</u>	<u>4,922</u>	<u>3,277</u>	<u>10,604</u>	<u>19,768</u>

1976 Terminals by Type and Industry

EXHIBIT 4-17



1976 Data Communications Traffic by Type of Terminal (in Millions of Characters Per Day)

	Remote Batch	CRT	TTY	Other Terminals	Computer to Computer	Industry Total
Financial	270.4	81.1	24.1	121.2	182.0	678.8
Service Bureaus	2,018.7	0.4	28.3	—	—	2,047.4
Resource	512.1	142.7	9.0	6.6	—	670.4
Manufacturing	304.6	28.5	4.9	28.1	45.9	412.0
Transportation and Utilities	236.7	323.5	13.3	251.6	23.8	848.9
Wholesale/Retail	197.3	7.3	1.1	6.8	—	212.5
Total for Type of Terminal	3,539.8	583.5	80.7	414.3	251.7	4,870.0
Percent of Grand Total	72.7%	12.0%	1.7%	8.5%	5.2%	

1976 Data Communications Traffic by Industry and Type of Terminal
(Millions of Characters Per Day) (54 Companies Reporting)

In Exhibits 4-18 and 4-19, we display the data set that, to our way of thinking, was most surprising to emerge from the DATACOM study, namely, traffic by geographical area in Canada, on both an originating and terminating basis and between originating and terminating locations, such that an origin/destination matrix could be constructed. It is important to bear in mind here that this comprehensiveness was achieved, in fact, with a very small sample size in comparison with conventional market research approaches. However, as shown in these actual figures the leading edge method does in fact work very well in circumstances to which it is appropriately suited, namely, in those situations where a quite small but nevertheless very knowledgeable set of respondents--be they individuals or companies it should be noted--are available to be surveyed in depth and questioned on information and ideas for which they have, in fact, substantial and reliable answers.

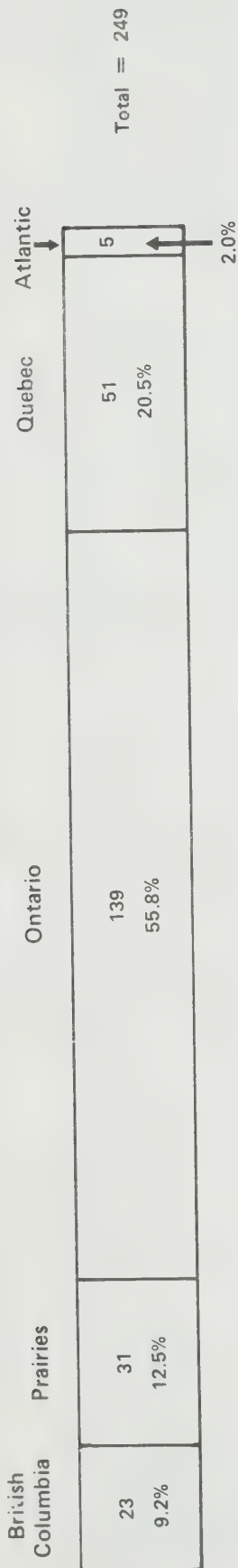
There is one caveat that should be mentioned with respect to the leading edge method before leaving the discussion: in order to utilize it there must, of course, be leading edge users of the product or service under study in the first place. As is obvious, there are now no videotex or teletext users in Canada at all, because these services are not yet available. However, in the case of these services as well as many others that might develop in Canada, initial efforts are, of course, occurring elsewhere--eg. videotex and teletext in Europe, pay television, home protection, pay by phone and other similar services in the U.S., and so forth.

Bearing these considerations in mind, what we will be recommending in this report is the use of the leading edge method in a 'modified' form, that is, to seek out those organizational entities that are applying new home and business services in real markets, wherever they are occurring, to ascertain, in the same way as the leading edge method has been shown to have been used in business, actual, observed usage patterns as they are occurring in practice. There is some overlap here with the retrospective survey approach, which has some of the same objectives. In combination, however, these two methods are expected to be very useful as research techniques for new home and business service demand studies, and we will be recommending strongly that they be used in such a research programme, in Part C of the report.

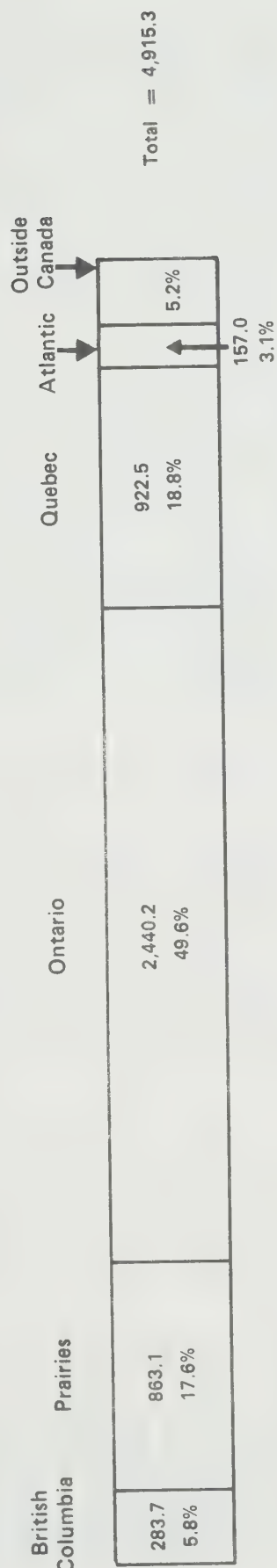
'Supply-Push Extrapolation'

We introduced this method earlier by referring to the fact that it is the one used to produce most forecasts, especially of high-technology markets, that are widely publicized. It is not necessary to linger over the method in any great detail, because it is not one we recommend DOC undertaking on its own. It may be useful to take note, however, of some of the method's more interesting aspects.

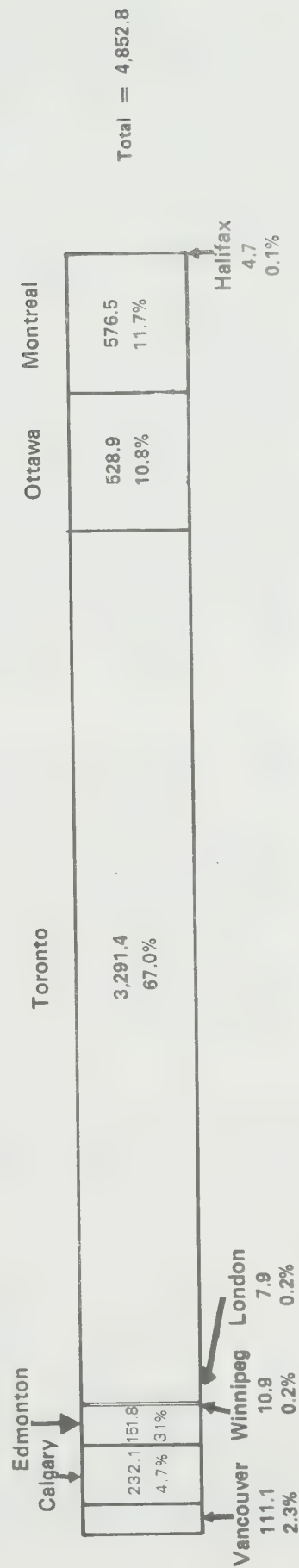
OF COMPUTERS



OF TRAFFIC BY ORIGINATING LOCATION (millions of characters per day)



OF TRAFFIC BY DESTINATION (millions of characters per day)



LOCATION OF COMPUTER CENTRE										
TERMINAL LOCATION	Vancouver	Calgary	Edmonton	Winnipeg	London	Toronto	Ottawa	Montreal	Halifax	TOTAL
N.W.T./Yukon	0.8		1.3			0.1				2.2
Vancouver/Victoria	58.6	72.4	2.5		0.7	111.7	0.1	1.5		247.5
B.C. Other	22.4	0.1	0.1			7.9		3.6		34.1
Calgary/Alberta South	0.7	103.7	142.8		0.2	163.0	5.2	0.8		416.4
Edmonton/Alberta North	1.5	33.1	2.0		0.3	43.3	0.2	6.5		86.9
Regina/Saskatchewan		2.4	1.0	1.2	0.1	122.2	0.2	3.6		130.7
Winnipeg/Manitoba	2.6	20.4	0.4	3.6	0.3	103.3	0.3	98.1		229.0
Thunder Bay/Northern Ontario				1.5	0.4	58.8	8.1	4.9		73.7
Windsor/London/Sarnia	0.2		0.1	0.1	0.7	63.5	10.1	4.3		79.0
Hamilton/Niagara Penn.	0.2				0.5	104.9	0.1	0.8		106.5
Toronto/Kitchener/Barrie	10.6		0.1	2.5	2.9	1,586.7	16.8	38.8		1,658.3
Cornwall/Eastern Ontario					0.2	10.7		26.3		37.2
Ottawa/Hull	1.0				0.3	160.1	317.2	6.8		485.4
Montreal Area	8.5		0.1	0.8	0.8	465.0	51.3	285.3		811.8
Quebec City	0.1					24.0	2.7	10.0		36.7
Quebec Other						32.2	10.9	30.8		73.9
New Brunswick					0.2	23.5	0.3	4.0	2.1	30.1
Prince Edward Island						1.0		0.2		1.2
Newfoundland						8.6		4.1	0.6	13.3
Nova Scotia					0.3	88.0	1.8	13.9	2.0	106.0
U.S.A.	3.9		1.4	1.2		84.3	103.6	26.3		220.8
Europe						21.5		5.9		27.4
Asia						0.5				0.5
Mexico & South America						6.5				6.5
Africa										
TOTAL	111.1	232.1	151.8	10.9	7.9	3,291.4	528.9	576.5	4.7	4,915.3

EXHIBIT 4-19 1976 Origin and Destination of Traffic Volumes (Millions of Characters Per Day)

Perhaps the first of these points should be the fact that forecasts will always be made by someone, if for no other reason than to gain publicity for doing so. In general terms, however, such numbers have little credible base at all if they refer to 'new' products and services, and should more properly be interpreted as 'blue sky' or 'science fiction.'

On the more substantive side, however, are situations in which reputable firms are attempting to perform a genuine service, by providing for other's consumption their own estimates of what the market for a given product or service will be at some time in the future.

'Supply-push' is the method most often used for doing this because, principally, it is efficient and inexpensive. What is generally done is to contact suppliers in the industry in question and establish with them agreements to disclose, on a confidential basis, their own (i.e., the suppliers') estimates for present values and growth characteristics of the product or service under study. The researcher then contacts other suppliers in the industry and asks them the same questions. This process is continued until a range of responses is obtained that the research organization estimates is 'enough,' on some subjective basis. The combined answers are then amalgamated, large doses of the researchers 'judgement' are added, and the forecasts are produced.

Surprising as it may seem, this process often produces very reasonable and credible estimates of the product's growth prospects--if the product or service is already in the market and has been there for some time. What is considerably more dangerous, however, is to rely on supplier data at very early stages in a product's life cycle. One example of this is illustrated later in our report where various estimates of Prestel terminal production by the British Radio and Electronic Manufacturer's Association (BREMA) are reproduced. (See Chapter 6). There, it may be clearly seen that estimates have been consistently higher than actual production, from the time estimates were first made even until now.

Despite these cautions it would be reasonable to anticipate that market estimates derived in the above manner have substantial usefulness as check points and backup data, and can often be purchased by the Department as a participant in a multiclient project. This form of obtaining such information is one we would recommend.

OTHER 'DESK-BASED' MODELING AND ANALYSIS METHODS

Competitive/Complementary Analysis

Competitive/complementary analysis is a somewhat difficult research activity to describe in completely satisfactory terms, because, as we are

using the label in this part of the report it refers to methods which are rather more subjective than objective. The basic notion, however, is that in many areas alternative ways of accomplishing a given task are available (such as writing a letter or making a telephone call, taking a trip or using teleconferencing), and one is faced with the task of estimating the effect of one new service on another.

As we will presently see, one way to formulate this problem is at the most disaggregate level of all, the individual decision-maker, making a choice between whether to phone or write, or travel or teleconference. A great deal will be said about this way of looking at the problem later because the 'modal choice' formulation is the whole basis of our discussion of 'disaggregate' activity models. It should be recognized, however, that at least in certain circumstances there are different ways to formulate the problem of one type of service versus another, namely at the aggregate level. It is this type of research that we discuss in this section.

Approximately 1 1/2 years ago a research project was completed for Canada Post (Price Waterhouse Associates and R.W. Hough and Associates, 1977) that was titled "Threats and Opportunities Study." This project had as its specific objective a detailed analysis of the information transfer market in which the Post Office participates. The notion behind this of course was exactly what we are discussing in this section, i.e., competitive (and complementary) market forces.

Canada Post recognized that such a study could be accomplished by adopting, itself, some of the research notions we have already presented-- in particular, the aggregate transaction model idea. They established therefore an 'information transfer study team' to investigate, both inhouse and via contract research, how letter mail fit into the overall demand for information transfer, how that demand was changing over time and into the future, and how the Post Office might, if it so chose, participate in other sectors of the market than letter mail.

It is not for us to say, of course, whether or not Canada Post should do things other than carry mail, nor do we intend to imply anything on this subject one way or another in this report. What is clearly relevant and of value, however, is how the work was accomplished, as an example of the competitive/complementary analysis approach. Exhibit 4-20 starts this process by demonstrating a very interesting way to observe and graphically illustrate how the competitive process has been operating over time in the context of 'mail.' As shown, in the early 1800s there was no competition for mail; over time, however, many other means for transmitting messages and information have been established, until at the present time not only telephone and telegraph are available but telex, TWX, data communications, couriers, and so on.

EXHIBIT 4-20

HISTORICAL EVOLUTION OF MAIN INFORMATION
TRANSFER SERVICES

						COURIERS	COURIERS
							SATELLITES
						COURIERS	COMP COMM.
						DATA COMM.	DATA COMM.
						TWX	TWX
				TELEX	TELEX	TELEX	TELEX
		TELETYPE	TELETYPE	TELETYPE	TELETYPE	TELETYPE	TELETYPE
	TELEPHONE	TELEPHONE	TELEPHONE	TELEPHONE	TELEPHONE	TELEPHONE	TELEPHONE
TELEGRAM	TELEGRAM	TELEGRAM	TELEGRAM	TELEGRAM	TELEGRAM	TELEGRAM	TELEGRAM
MAIL	MAIL	MAIL	MAIL	MAIL	MAIL	MAIL	MAIL
1800's	1850's	1900's	1930's	1950's	1960's	1970's	

Of course, recognition and display of these changes represents only a qualitative picture: what is needed is a quantitative one. To accomplish this, the basic aggregate transaction model approach was used, taking into consideration the fact that 'messages' (or alternatively, 'letter-equivalent volume') was the most appropriate and meaningful measure for comparison purposes. From this, aggregate figures were built up over all the services of interest, including mail, and estimates were made in certain cases of the additional impact in the future of new services over old ones--the potential, gradual decline of TWX and telex being one example.

Exactly the same kind of approach is needed in the new home and business service area. In the home area for example, in addition to 'older' products such as newspapers and magazines, a whole host of new products are becoming available, such as personal computers and electronic games. At this stage the significance of these products to Telidon/videotex cannot be ascertained in quite the same way as was just illustrated, that is, with historical, numerical data. Extremely important qualitative aspects can at least be brought out, however--whether or not certain services such as games, for example, might not be made available on a standalone basis more cheaply than on a "transaction" basis via Telidon. The competitive/complementary analysis approach provides a framework for this type of investigation, and thus is another method recommended for DOC use.

'Hypothesized' Take-Up Models

As will be remembered from Chapter 3, we suggested that Hickling-Johnston's analysis of Telidon growth potential, based on income distribution and postulated household budgets, could be treated as, for want of a better term, a 'hypothesized' model for estimating take-up of the service over time. We have found it very appropriate in our report to expand on this method in some detail, in response to one of our own tasks, namely, providing preliminary estimates of the relative potential strength for videotex at home and in business (Appendix A). As a result, no elaboration on this method is necessary at this point, since a quite sufficient discussion may be found in that part of the report.

Diffusion of Innovations

'Diffusion of innovation,' as we implied earlier, is a rather difficult technique to grapple with since it has been approached so often from the qualitative as opposed to quantitative perspective.* We are inclined, accordingly, to treat the area very lightly, covering only one or two ideas that appear useful.

* There are some exceptions to this general statement which though not discussed here would be appropriate areas for further investigation. These include mathematical models of the diffusion process by E. Mansfield and others.

It has been pointed out that consumers (no doubt including firms) can be classified into groups representing their 'propensity' toward innovation--(the latter being our own term). One way this can be done is in terms of 'adopter categories,' i.e., innovators, early adopters, early majority, late majority, and laggards.* According to this scheme, innovators constitute a small proportion of the population, estimated as about 2.5%, while the rest of the population are distributed across the other four categories according to a normal distribution or bell shaped curve.

This notion, of course, is not directly helpful. On the other hand, there are obvious parallels with the leading edge concept as it was reviewed above, in that, no doubt, if leading edge firms can be identified they would also be likely classed as 'innovators' in the above classification scheme.

To identify innovators is, of course, one of the objectives of a good marketer. What appears to be a very useful concept then, in the context of new communication services, is to attempt to target the first uses of the new system or service specifically to those firms and individuals who might be most receptive to it.

In some sense, of course, this violates the notion of objective research. What we have clearly found in practice, however (see, for example, Hough, 1977; Burns, 1978) is that if new systems fail to grow on their own, perhaps they will grow (or 'take off') with appropriate stimulation. One of the ways to do this is to better target the service to receptive audiences.

The 'adoption process' notion mentioned in Chapter 3 is also instructive. Here, attention is drawn to different stages a buyer or potential buyer may go through on his or her way to a purchase/no purchase decision. These have been characterized, again highly qualitatively, as awareness, interest, evaluation, trial, and adoption (or rejection). (Schiffman and Kanuk, 1978). Again, such notions are not useful in any direct sense, but are perhaps so in an indirect way. This might also, therefore, be a fruitful area for further investigation.

* E.M. Rogers, Diffusion of Innovations, Free Press, 1962.

EXPERIMENTAL/TRIAL-BASED APPROACHES*

Laboratory Experiments

The cost and difficulty of field trials, their inherent lack of controllability of user activities in the case of testing specific hypotheses, and the consequent limitations on the amount of testing that can be accomplished, has attracted attention to the potential usefulness of the kind of controlled laboratory experiment on human behaviour familiar to experimental psychologists.

The application of such laboratory experiments to the assessment of new telecommunications media was pioneered by the Communications Studies Group (CSG) at University College, London between 1970 and 1976. The experiments at CSG focused on various measures of the effectiveness and acceptability of different types of teleconference facilities, audio and audio-visual, by comparison with the 'control' situation of face to face meetings similar in every respect except in the communication medium used. The studies produced important findings on the role of audio and video conference systems leading to the conclusion (now widely accepted) that the utility of the video channel is usually very limited (CSG, 1975; Pye and Williams, 1977). The experimenters, confronted with the fundamental problem of realism of experiments, showed that in situations where the context is not crucial (as in the effectiveness of problem-solving within a work group), realistic experiments can be achieved, if 'real' experimental subjects (in the CSG case, civil servants and businessmen) are used. However, where contextual factors are very important, as in determining users' willingness to pay for a new service, the experimental method appears to have only very limited value.

Where the 'new home and business services' now receiving priority consideration in Canada are concerned, it is clear that behavioural laboratory experiments can contribute little to resolving the central questions about user acceptance, utility and 'willingness to pay' in a realistic setting. However, they could be of significant value in assessing the specific acceptability and relative merits of specific system features (eg. the method of information search--for instance, 'free' or 'keyword'--in a videotex system) in a preliminary effort of relatively low cost designed to indicate design features (both of system, and nature and form of content or 'serviceware') most likely to make the field trials successful in generating data about users and demand.

Apart from the CSG work discussed above the role of laboratory experiments in the development of new telecommunication services has traditionally been restricted to 'human factors' research (eg. the spacing of symbols on keyboards and the readability of text messages). This type

* Field trials are covered in Chapters 5 and 6.

of research, while valuable, does not do justice to the potential contribution of experimental research. The laboratory experiment gives the researcher the opportunity to observe events which occur at a determined rate (rather than waiting for opportunities to record naturally occurring events) and under circumstances which are controlled. Given this background, they are of value in any investigation where there are specific hypotheses to test, provided that the activity can be reasonably simulated. The results of these hypothesis tests can then either be used directly in making judgements about potential levels of demand, or drawn upon in determining model structure or parameter values for demand models.

The best documented use of laboratory experiments in a wider modeling framework is the series of experiments conducted on teleconferencing at the Communications Studies Group referred to earlier, which were used in the demand estimation study by the Post Office Long Range Studies Division (Tyler, et al, 1977). There is a potential use for experimental studies to gain data on user acceptability for service alternatives such as database search procedure for videotex, format acceptability for text message systems, and so on. Optimal use of laboratory experiments would fit them into a longer term research strategy, alongside use of other demand estimation techniques.

Retrospective Surveys of Field-Trial Experience

At the beginning of our report we referred to the fact that a number of new telecommunication service 'ideas,' all tried out in the field, have failed to stimulate a growing market. We mentioned Picturephone^R, which is known to many and referred to often.

Unfortunately, AT&T has probably received more than its share of adverse publicity from the (present)* failure of Picturephone, because many other new innovations, perhaps initiated more by government than by industry, have so far been unsuccessful in the real marketplace.

The only way we know this to the degree that we do today, however, is with retrospective surveys. This type of research is of value for a very great variety of reasons, not least of which is simply cataloging for the record--in one place--experiences others have had trying to implement new services. Of even greater significance, however, is the fact that

* It should be clearly recognized that regardless of present appearances it would be just as foolish to write off videotelephones forever as to have written off the telephone itself when it first appeared. It may be that this service is never useful; it might also be, however, that prices will fall extraordinarily at some point in the future, and a market develops after all. All one can say therefore is that no market has developed for Picturephone (or other videotelephones) at today's prices.

such research, if conducted properly, can be used to establish very significant and well established generalizations concerning new systems and services, that are in fact borne out under actual use conditions.

It should be thoroughly understood that these are the kinds of survey approaches we are talking about here. It is clear that a 'simple' survey of 'what people are doing here and there' is of useful but limited value. If, however, significant attempts are made to analyze the information collected--and even more strongly compare and contrast it with research evidence coming from other sources--the 'retrospective' method we are referring to becomes an analysis technique, not just a survey.

There are, it may be well to point out, examples of both of these kinds of approaches--i.e., surveys only and surveys with analysis. As mentioned earlier, three examples of the second type are:

- Leduc and Shepard, "Review of Projects on Future Communications Systems" (1979).
- Elton and Carey, "Interactive Telecommunications Systems: A Study of Implementation Problems" (provisional title) (1978-79).
- Hough, with Panko, "Teleconferencing Systems: A State-of-the-Art Survey and Preliminary Analysis" (1979).

Unfortunately, time and budget constraints prevent us from dealing with any of these in great depth. One or two brief examples, however, will suffice to illustrate the points we are making. From the first study for example, which covered "almost 200 projects in 7 countries," a striking conclusion is reached (Leduc and Shepard, 1979, p.8):

Perhaps the best concluding observation is that none of the services tried out in the projects reviewed is in widespread use today [emphasis added]. The level of experimentation is increasing, but the economics of the marketplace are just beginning to be sufficiently attractive to stimulate large scale investment.

In other words, the 'technology push' we mentioned at the beginning of our report is operating at a fever pitch--especially when it is recognized that Leduc and Shepard reviewed, for the most part, relatively recent projects: Picturephone is not even among them!

We are, of course, oversimplifying here. On the other hand, it cannot be denied that an enormous amount of money is represented by these 200 trials, demonstration projects, experiments, and so on. All of these funds, one should hasten to add, were spent in good conscience. The fact remains however that the projects have not been taken up in the marketplace, and the question is, why?

We are able to address this with only a single example, but we believe this will be sufficient to demonstrate our belief in the retrospective analysis approach. Immediately above, in the section on laboratory experiments, we referred to the fact that the Communications Studies Group established, during 1970-76, some very important conclusions with respect to teleconferencing, namely, that in such systems, the video channel is not nearly as important (or effective) as one would tend to believe on the basis of intuition alone. These results, it should be noted, were established in a laboratory setting, and were confined to that setting--that is, until they could be confirmed in actual practice.

This is one of the things that was accomplished with the third study mentioned above (Hough, 1977). In that work, there was no preconceived notion at all as to what one would find from a survey of teleconferencing systems. There was, however, a conviction throughout the study that an analysis of the systems was what we were looking for, i.e., 'indicators' and 'insights' that could lead to useful generalizations. On this basis as well as others, actual use (coming back to this point we have mentioned so often) was a key, prime factor in the investigation.

The result of this concentration bore fruit. In the course of the work, one factor perhaps more than any other emerged--i.e., despite the extraordinary concentration from the supply side on video what the market wanted was audio,* thus not only confirming CSG's results in theory, but in practice as well.

It is impossible to do justice to any of the previous work in this area in this report, as is obvious from our cursory treatment of it. The reader will recognize our enthusiasm for the retrospective method, however, if it is indeed, retrospective--that is, conducted with analytical purposes in mind. We believe this same kind of approach should be used with new services, and are confident that if it is, useful and fruitful conclusions will result.

* Again, lest there be a misunderstanding, this refers to present market only. We also said in our report (p. 163) that "people want video." However, they don't necessarily know why they 'want' video, nor how expensive and difficult it is to get it at present.

CONVENTIONAL MARKET-SURVEY METHODS: THE MARKETING RESEARCH TRADITION

For many professionals active in the planning of new telecommunication services, the natural response to uncertainty about demand for these services is to commission 'market research'. As conventionally conceived, such research involves administering an interview or self-completion questionnaire to a carefully selected sample of people in what is felt to be the group of potential users of the new service. Highly sophisticated methods are available for sampling, for maximizing the comprehensibility of the questionnaire, for motivating considered answers, and for minimizing bias. These methods are available in any good survey research organization, and are undoubtedly essential if any survey-based research in this field is to be of value.

Nevertheless, in reviewing experience over the last fifteen years, we have come to the conclusion that there is a fundamental flaw in studies which use these methods simply to ask respondents direct questions about communications media of which they have little or no direct experience. To take a concrete example, survey respondents know what mint is, what stripes are, and what toothpaste is--and have well-tryed views about each--so that the 'direct question' approach is quite appropriate to the task of testing the market for striped, mint-flavoured, toothpaste. On the other hand, they do not have experience or well-established views relevant, even by analogy, to Electronic Funds Transfer from the home, Telidon electronic publishing, or the use of teleconferencing.

We are very much convinced that surveys which ignore this are of limited value--especially as regards the crucial question of 'willingness to pay' for the new service, as opposed to general statements of preference. As is well known, the marketing failure of Picturephone[®] in the early 1970s was preceded by extensive market research of this kind, which failed to sound the necessary danger signals. Similar research on the Confravision studio-based video teleconference system operated by the British Post Office also gave favourable results not subsequently borne out by experience. In fact, the results of such studies are very hard to interpret: by contrast with the other approaches discussed in this chapter, the mechanism influencing user behavior cannot be explicitly investigated, either experimentally or by simulation, so that assumptions are implicit and cannot be tested.

Exhibit 4-21 illustrates this: it summarizes the results of market research study carried out by the Telecommunications Marketing Department of the British Post Office in 1975, into the potential for a variety of advanced telephone facilities not available then (or now), except on a few advanced PABX installations. Respondents in this study ranked a series of the new services and facilities on a scale of 0 to 4 according to their perceived likelihood of using the new service. Some general insights can be gained from these results, especially where comparisons are made between different service offerings, as is apparent in Exhibit 4-21. Notably, we find relatively little perceived need for telephone conferences outside

EXHIBIT 4-21 - MARKET SURVEY RESULTS FOR ADVANCED TELEPHONE SERVICES
AND FACILITIES

Service or Facility	Group	mean score (4 = very likely to use)	% of respondents giving score of 3 or 4
3-party telephone conferencing	multiple line business customers	2.66	42
	single line business customers	1.44	28
	residential customers	1.12	22
'ring when free' exchange continuing to call a number if engaged tone is encountered, and rings original caller when called party eventually answers	multiple line business	2.93	73
	single line business	3.03	72
	residential	2.32	54
call waiting indication	multiple line business	2.25	50
	single line business	2.32	51
	residential	1.68	38
Alarm calls	multiple line business	0.65	12
	single line business	1.25	26
	residential	1.48	32

Source: British Post Office Studies

the larger business establishments, whereas for such establishments telephone conferencing is broadly viewed as favourably as other advanced telephone services and facilities.

However, there are inherent limitations in this type of approach: no deductions at all about users' 'willingness to pay' for the new services and facilities can be derived from Exhibit 4-21, or from the study as a whole, nor is the likely frequency of use - and hence the volume of demand - indicated. Where users lack experience of the service in question, questions on these aspects would be highly 'hypothetical' and would be unlikely to elicit valid responses.

There is research evidence to support our own experience in justifying this sceptical view. Ehrenberg (1966) in a meticulous and widely cited review of marketing research, takes the view that no evidence has yet been found to show that answers to survey questions about 'intentions-to-buy' can validly be used to predict changes in actual buying behavior. A close systematic relationship does, however, exist between the percentage (I) of people who express an intention to buy the brand in question and the current usership level (U) of the brand. This can be expressed as

$I = K\sqrt{U}$, I being directly proportional to the square root of U.

Unfortunately, this is of little use in assessing the usefulness of data on 'intentions-to-buy' for new brands or services. Deviations from the square root relationship occur within the limits of $\pm 3\%$ for successfully launched new brands, as well as slowly dying old brands, i.e.:

- Fewer people than the norm say they intend to buy what subsequently prove to be successful new brands, but more people do in fact buy them subsequently.
- More people than the norm say that they will buy dying old brands, but fewer people go on buying them in the long run.

The need to validate any data on 'intentions-to-buy' by checks on subsequent buying behavior is obvious enough from Ehrenberg's rather devastating analysis.

Does this mean that surveys in the 'marketing research' tradition have no use at all, apart from giving a very 'soft' and general initial impression of some qualitative market characteristics, and those mainly to do with present awareness and perceptions rather than likely future

behavior? Yes, if the survey methods are used in their traditional role. They do, however, have three very legitimate applications in investigating the demand for new communication services. Each of these has been used extensively in the research programmes at the Communications Studies Group and subsequently at CS&P.

- As an aid to laboratory experiments or field trials.

The market research sampling and questionnaire techniques can be of great value in 'placing' experiments or field trial services in an appropriate and controlled way among the right group of potential users. For example, a 'screening' pre-survey designed to aid selection of participants and provide data for 'before and after' comparisons of attitudes and behavior can be particularly valuable. Similarly, the questionnaire techniques can be invaluable in maximizing precision and clarity and minimizing bias in the data collected from participants.

- As a data-collection instrument for demand modelling work

The demand modelling methods discussed in this chapter, especially the disaggregate methods which build up their overall picture of demand from data on individual behavior, require large amounts of data on the characteristics of potential service users, their behavior, and a present-day information flow. The survey tools developed in the market research tradition are extremely valuable for the collection of such data.

- As a basis for indirect and qualitative inferences about market structure and opportunities

Even though direct conclusions about demand from surveys are of little value, valuable qualitative findings about demand can often be inferred if the respondent has experience of some activity that differs from the proposed new electronically-based service only in certain sufficiently well-defined ways. Two recent examples from the UK may be helpful in giving concreteness to this idea. One study, illustrated in Exhibits 4-22 and 4-23 by means of data from a pilot survey, investigated the potential for new Electronics Funds Transfers and Transaction services to the home or at Point of Sale by analyzing users' evaluations of existing ways of doing the same things and then addressing the questions -

- would the new electronic alternatives be likely to be evaluated as better or worse than the existing media along the dimensions identified as important by

EXHIBIT 4-22 - MEANS OF PAYMENT: IMPORTANCE OF CHARACTERISTICS

CHARACTERISTICS:-	IMPORTANCE			
	VERY IMP. 1	QUITE IMP. 2	NOT VERY IMP. 3	NOT AT ALL IMP. 4
CONVENIENCE	16	2	2	-
CONTROL	11	3	-	4
SECURITY	10	5	3	2
COST	7	3	6	4
CONFIDENCE	6	1	1	2
SPEED	5	5	4	4
COMPLICATED	5	3	1	-
HELPFUL	3	4	2	-
INVOLVES NEW TECHNOLOGY	3	-	-	3
INTEREST RATE OFFERED	2	5	3	-
DELAY	2	4	4	7
FACILITATES FINANCIAL PLANNING	2	4	2	1
EASY BORROWING	2	3	2	3
INERTIA	1	-	4	-
FRIENDLY/PERSONAL	-	4	5	1

Note: Table specifies number of times each level of importance cited

EXHIBIT 4-23 - METHODS OF PAYMENT: PERCEPTIONS

METHODS OF PAYMENT												
	CHEQUE	CREDIT CARD	STORE ACCOUNT	QUARTERLY BUDGET ACCOUNT NATIONALIZED INDUSTRY	DIRECT DEBIT	VARIABLE AMOUNT DIRECT DEBIT	STANDARD ORDER	PO GIRO	BANK GIRO	POSTAL ORDER	BANK LOAN	BANK BUDGET ACCOUNT
Convenience	11	5	4	1	1	2	9	2	2		4	
Controllable	2			1			1					
Costly		3						2				
Delay		1										
Security	4						4	1	2		2	1
Inconvenient	1	1						1				
Don't have to remember/ less worry					1		3					
Lack of control			1	1		3						
Quick					1	1	1					
Easy							1	1	1			
Aids financial planning										2		2
Risky												
Widely acceptable	1	1								1		
Complicated												1
For small amounts										1		
Available												
Lack of trust				1								
Low cost					1		1	1	1			
Easy borrowing			2									
Impact on cash flow			1	1								
Confidence	1						1					
Helpful												
Regular	1						1					

Note: Table specifies number of times each use cited

respondents? This was tested both by hypothetical questions and by questions about broadly analogous systems that are already familiar, eg. computer prepared bank statements, 'automatic tellers', etc.

- does the multi-dimensional positioning of the existing financial media along the various dimensions show clear 'gaps' which could be filled by the new media?

Similar work is currently being carried on by CS&P in the UK to see whether a small-business system based on videotex, including transaction service, intelligent terminals, and the 'downloading' of software containing up-to-date parameters for tax, salary deductions, etc. would fill such gaps or perceived needs in the administration of small business. The interim results of this work are distinctly encouraging.

This latter type of study is a special case of 'morphological' or 'market segment' research, which is discussed further in Appendix C.

DEMAND MODELLING AT THE 'BEHAVIORAL' OR 'DISAGGREGATE' LEVEL

Introduction and description of Disaggregate Activity Models

We use the term 'activity models' for methods of demand estimation which seek to identify the place of each new medium in the overall pattern of flow of information or transactions in order to assess the likely demand for it. Such models represent in effect an extension, in more elaborate and explicit form, of the approach which seeks to infer the likely level of demand indirectly from all the available evidence, rather than relying on survey respondents' speculations or waiting for reliable data from large-scale, long-term field trials. The foundation of these models is survey data on, or estimates of, the scale, content, and other characteristics of information flows--but many other kinds of economic and behavioral data, including those derived from the field trial, laboratory experiment, and market survey methodologies reviewed in previous sections, are typically needed.

The three fundamental tasks facing such a modelling exercise are:

1. To predict what the scale and pattern of information flow will be after the full effects of introducing the new medium have been felt.
2. To predict what share the new medium will take from different parts of the total information flow, and how the shares of the other media will change as a result.

3. To derive an analysis of the characteristics of the information flow carried by the new medium (which could include content, types of uses, 'holding times', time-of-day peaking, or innumerable other variables).

The balance of emphasis between the second and third of these points will differ according to the purpose of the demand study being undertaken. Sometimes the first stage will be eliminated by simply assuming that the overall pattern of information flow will be unchanged by the introduction of a new service: in that case, we have a pure substitution or diversion model, which does not allow for 'generation effects' in which the existence of the new medium creates entirely new information/communication demands or changes the character or scale of the established demands.

The development of disaggregate activity models may be approached in a variety of ways, but demand-prediction models for new telecommunications services all have the same general four-stage structure:

- (i) a population of potential users is defined
- (ii) this population is disaggregated into classes of people or organizations (sometimes down to the level of individuals), and further disaggregated into classes of events (e.g. the British Post Office's model of the market for teleconferencing)
- (iii) a sub-model is used to provide estimates of usage within each class
- (iv) total usage is obtained by aggregation over the classes.

The various forms of demand model for new services arise from different ways of specifying each of these four steps. The first two steps are relatively straightforward, though involving very important questions of model design--including trade-offs between specification error (by increasing the complexity of the model and the number of categories) which tends to be the greatest for the simplest models--and statistical measurement error. Statistical measurement error is due to the small size of sub-samples in the data base and can be reduced by simplification and the use of fewer categories. It is, therefore, least for the simplest models.

The fourth stage is a matter of 'grossing up' the results for particular categories of users of a new service application, to obtain demand forecasts at the aggregate level. This requires a knowledge of the sampling rates for these categories, and sometimes other statistical parameters. While aggregation problems are far from trivial in principle (there is a whole branch of the econometrics literature devoted to them),

they do not usually pose serious problems for the kinds of models we are concerned with here. We shall therefore concentrate on stage 3 of the modelling process, which can be designed in a whole variety of different ways.

One approach, which we need not linger over, is the application at the disaggregate level of the various kinds of extrapolation or 'leading edge' approaches discussed earlier. Some of the more ambitious forecasting studies for data communications, notably the Eurodata Study, have adopted this approach; and where resources do not allow the use of more sophisticated algorithms for 'stage 3' of the model, this is the most legitimate method available. However, it fails to exploit one of the most distinctive advantages that can be obtained with disaggregate models, namely the possibility of using algorithms which describe 'cause and effect' at the level of the individual decision-maker and which therefore permit extensive sensitivity testing. In sensitivity testing work, the model is used to demonstrate the effects on estimated demand levels in response to such externally-determined exogenous variables as the price of the new service, other characteristics of the new service, the price of close substitutes, or the level of household income.

Models which do have this sensitivity characteristic embody an algorithm for the determination of demand levels in 'stage 3' which itself in turn has two parts, the second being an algorithm describing the user choice between alternative media for completing the same communication event or transaction. Experience with demand modelling for transportation studies has led many authors (see for example McFadden and Reid, 1975) to strongly follow such an approach. The two parts of the model are:

- The determination of the aggregate demand for a particular type of communication event (text transfer, say) by all modes taken together.
- The allocation of total demand to individual media, as a function of the large number of specific choices between media made by individuals.

There are two main methods for describing the user's choices between media. One is based on a sequential algorithm in which choice is represented by the application of a sequence of choice steps each based on specific criteria for choice. The other involves the representation of the factors influencing choice as a set of variables, each with a corresponding 'weight' indicating the direction and size of its influence on the overall choice of communications medium. These variables and their weights are incorporated in a single equation predicting which alternative communication medium will be chosen by a particular user for a particular communication event, either on a deterministic or probabilistic basis. We call such an equation a 'weighted factors' model.

Each of these two alternative approaches is reviewed below, before we go on to consider their respective merits and the fundamental problems of generalization to 'n' modes, and of validation and calibration of the models.

Sequential choice algorithm models

In this approach, a decision algorithm is set up which - on the basis of intuition and from the results of any relevant research findings that are available on the effectiveness and acceptability of each of the alternatives and its real and perceived costs to the user - is thought to represent the sort of decision rule which is implicitly used by communicators in choosing a medium of communication for a particular purpose. In its simplest case, the algorithm consists of a sequence of rigid decision rules, and can most conveniently be represented as a flowchart of the kind used in computer programming. An illustrative example for message services is given in Exhibit 4-24.

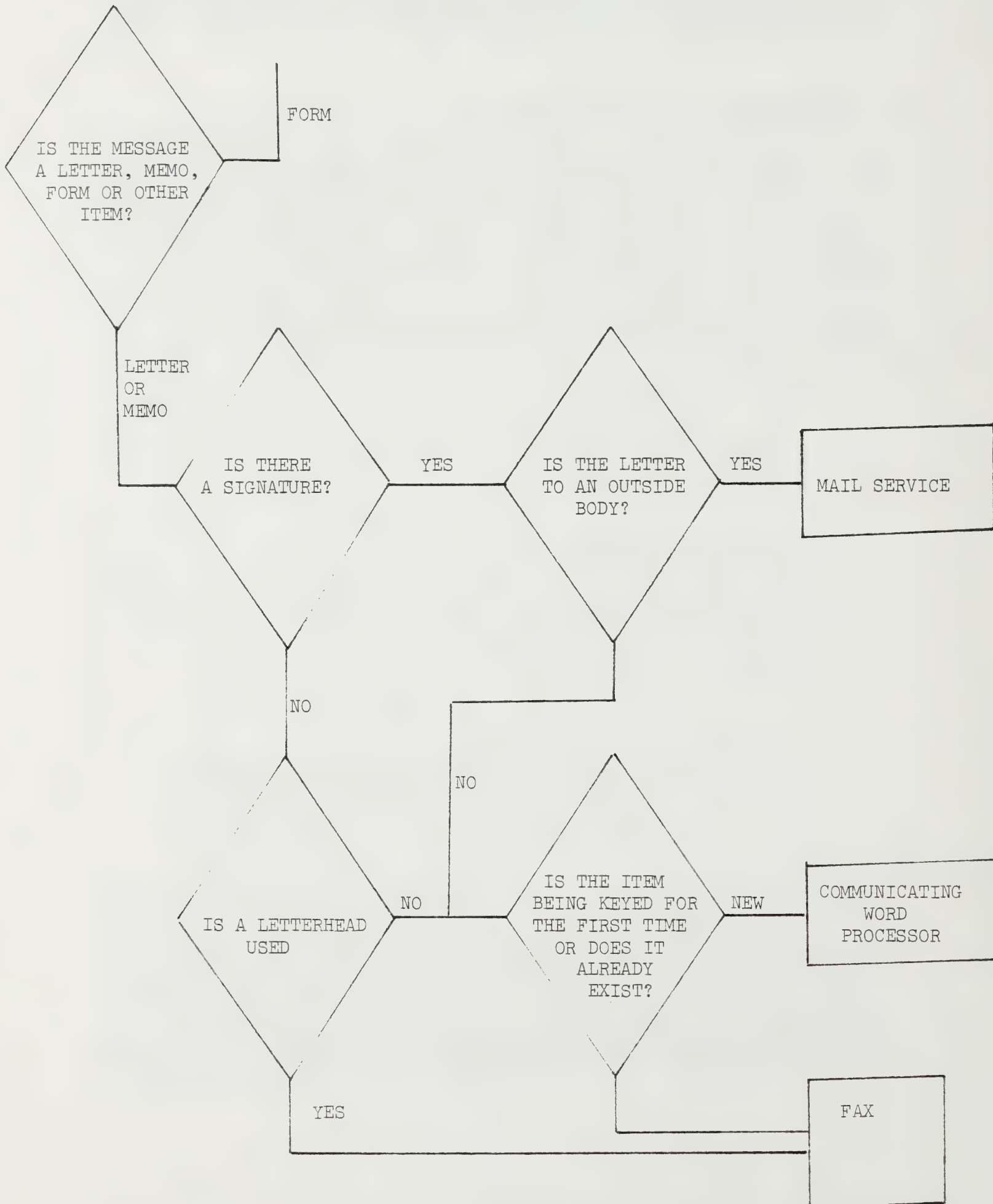
More complex versions of the algorithmic concept are possible, however. For example, the algorithms can be made probabilistic if some general qualitative knowledge of probability distributions is available, and a rigid 'yes/no' algorithm is thought likely to mislead.*

'Weighted Factors' Models

We use this term to cover a wide range of methods where, by contrast with the algorithmic approach, all the variables which are thought likely to influence the choice of medium are incorporated in an algebraic equation and considered simultaneously. Each method has two main components:

- An equation representing the choice process.
- A statistical procedure for securing the 'best' estimate of the equation parameters ('best' in some well-defined sense), and for calculating one or more measures of how well the choice behavior revealed by the data is accounted for by the model.

* One method developed by Tyler, Cartwright and Collins (1977) relies upon such prior research findings as how likely teleconferences are to be acceptable to users for different types of meeting. The parameters required at each step of the choice algorithm are then selected by the computer from a look-up table by a 'quasi-random' procedure constrained to conform, over a sufficient number of trials, to the a priori probabilistic distribution. This is known as the 'Monte Carlo' method, and is widely used in Operations Research work.

EXHIBIT 4-24 ILLUSTRATIVE (AND NOTIONAL) EXAMPLE OF AN EXTRACT FROM
A MEDIA-SELECTION ALGORITHM

Two broad kinds of approaches are under development, both fundamentally similar but differing in statistical detail:

- The 'discriminant' approach. Here the m variables $Z_1 \dots Z_m$ which are expected to influence the user's choice between media are combined in a linear weighted index known as the discriminant function. Individual variables included in this vector Z may describe the attributes of the alternative media, or of the decision-maker making the choice. Each discriminant function (if there are more than one) is denoted by a subscript i

$$D_i = d_{i1} Z_1 + d_{i2} Z_2 + \dots d_{im} Z_m \dots \quad (1)$$

In order to distinguish between only two outcomes (e.g. "use mail" or "use electronic media"), only one such function is needed. In this simple case, the computer program [such as that developed by Tuccy and Klecka (1975)] finds the discriminant function which gives the best separation of the two distributions as shown in Exhibit 4-25. The method is easily generalized for n groups, in which case $n-1$ discriminant functions are needed.

There are several alternative measures of "goodness of discrimination", known as:

- minimum Wilk's Lambda
- minimum Mahanlobis distance between groups
- largest minimum between-groups F value.

The process generates estimates of the model coefficients, d_i . If desired, stepwise programs can be used which 'weed out' the most useful small set of explanatory variables Z_m .

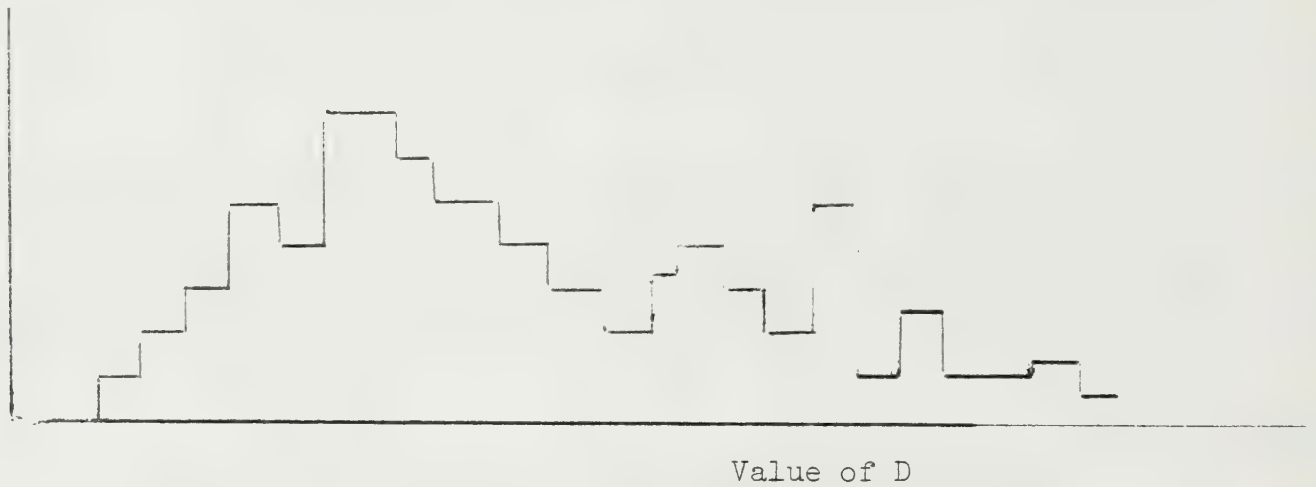
Three further steps can then usefully be taken:

- Set up a deterministic or probabilistic 'decision algorithm' for media choice, based on the discriminant function (e.g. if $D \geq 0.5$, users will send message by mail).
- Calculate what proportion of messages are misallocated by this method, and how good the overall model representation of flows by each medium is (usually the latter indicator is much more favourable than the former).
- See how well the selected model performs in explaining the pattern of data sets other than the set used for its initial estimation.

EXHIBIT 4-25

ILLUSTRATION OF SUCCESSFUL TWO-GROUP APPLICATION OF DISCRIMINANT ANALYSIS

frequency Observations where respondents sent message by mail



frequency Observations where respondent sent message by electronic means



There are two main snags in the above processes to be considered.

- (1) The theory of discriminant analysis assumes that the variables Z have a Gaussian (normal) distribution and that they have the same variance-covariance matrix within each group. Fortunately these conditions do not have to be adhered to very strictly - the method is 'robust'. In any case, this problem is most important in relation to the interpretation of 'measure of goodness of discrimination'.
- (2) Experience in transport studies shows that the effect of variables such as time input or cost on choices between travel models are highly non-linear: beyond a certain point improvements in the characteristics of one mode show 'diminishing returns' and no longer have much additional effect on modal choice. This effect can be represented by a function that relates the probability of each message-sending incident involving electronic media, say, as being a non-linear function of the discriminating variables Z . A model form of the kind

$$\begin{aligned} D' &= \exp \left\{ (-1) [d_{i1}Z_1 + \dots d_{im}Z_m] \right\} \dots \\ &= \exp (-C') \end{aligned} \quad (2)$$

has been used successfully in transport studies (Quarmby, 1967). It has the convenient property that D can be interpreted as a probability of choice of one of two competing modes. As $C' \rightarrow \infty$ this probability becomes arbitrarily close to zero; if $C' = 0$, all the users will use the favoured mode of travel or communication.

- Probabilistic choice models. A large literature in economics (McFadden, 1974), mathematical psychology (Luce and Suppes, 1965) and operations research exists on the subject of probabilistic models of choice between discrete alternatives. In many case, these models are developments of the exponential model set out above: for example Luce has

$$P_{jn} = \frac{\exp [V(Z_{jn})]}{\sum_{k=1}^J \exp [V(Z_{kn})]} \quad (3)$$

where P is the probability that person n will choose alternative j , and the $V(Z)$ are (usually) linear weighted indices akin to the expression C' in equation (2) above, so that $V(\underline{Z}_j) = \sum_n O_n Z_{jn}$

Given a data set comprising related data records on:

- which alternative was chosen on occasion 'n'

- what the attributes Z of the alternatives were on that occasion
- what the attributes of the decision-maker were,

the parameters θ of the choice model can be estimated by well-established statistical/computational techniques seen as Maximum Likelihood estimation.

The model can thus be tested and calibrated by seeing how well it reproduces existing patterns of choice between alternatives (e.g. between mail, telex, and facsimile). New alternatives--communicating word processors or computer mail, say--can then be represented by different values of the same vector of attributes Z, and the model re-run to determine the new market shares obtained when the new alternative is introduced, thus giving both a demand estimate for the new medium and an assessment of its likely impact on existing media.

It should be noted in passing that some authors (e.g. McLynn 1973) have been concerned at certain properties of the simple model of equation (3) that they suspect will bias estimates of demand for new media that are produced with its aid. The arguments involved are highly technical, and it would be inappropriate to reproduce them here. Suffice it to say that the problems are concerned with the validity of statistical assumptions underlying the model, and that a number of alternative model forms have been proposed in an effort to overcome them.

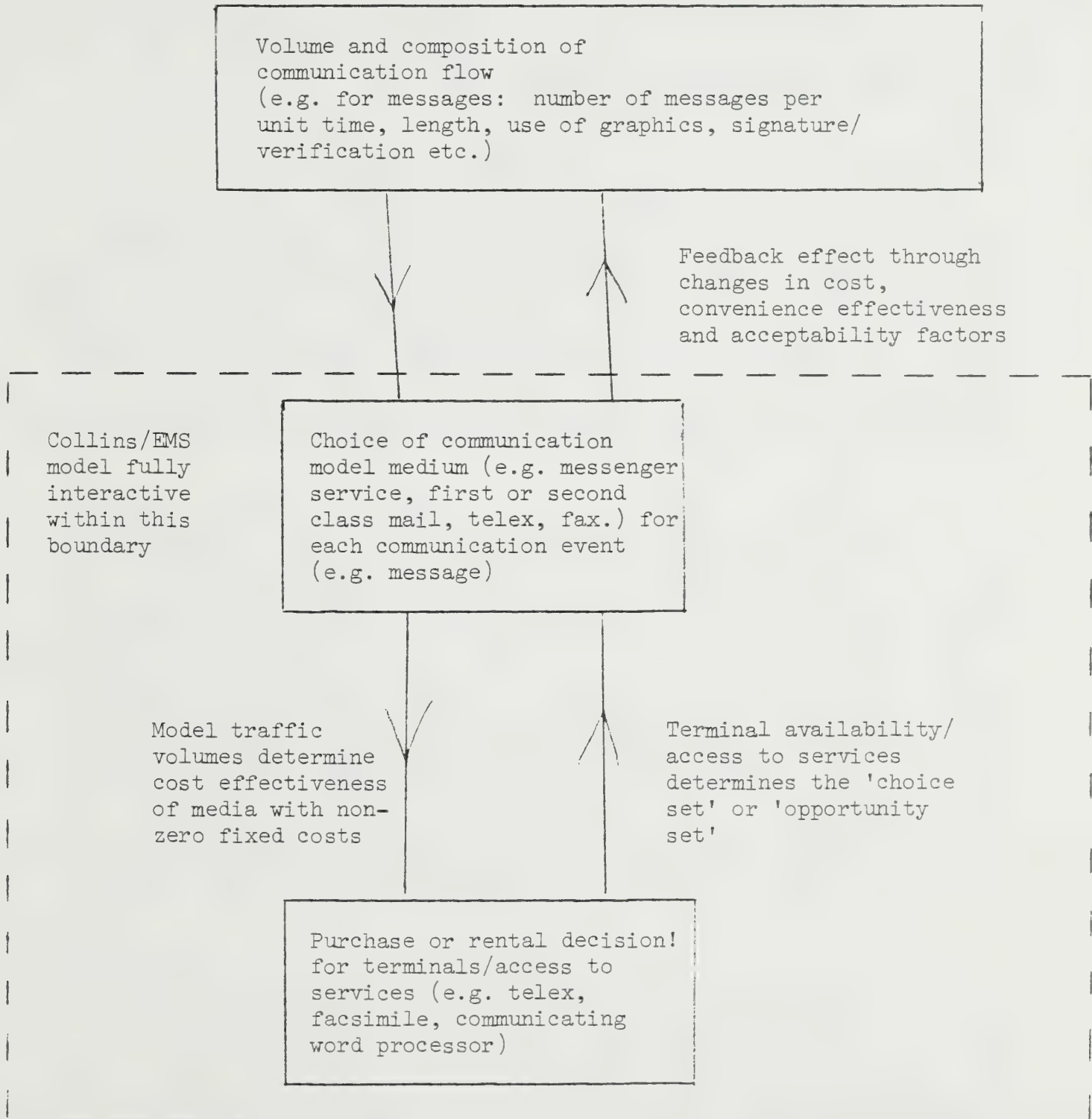
In principle, three kinds of user choices are inseparably inter-related, and ought to be simulated by model systems containing simultaneous equations describing all three, namely:

- The choice of how much and in what form to communicate (i.e. how many written messages? (A few long formal letters occasionally, or many, frequent short notes?))
- The choice of a physical model of communication (e.g. for second class mail, messenger services, facsimile, telex) for a particular communication event or transaction.
- The decision by an individual or (more commonly) an organizational decision-making unit to buy access to each individual telecommunication service by purchase or rental of terminals.

The concept of model simultaneity is illustrated for the case of 'electronic mail' in Exhibit 4-26, which notes that simultaneity for two of the sub-models was in fact achieved in the electronic mail choice model developed by H.A. Collins for the multi-national Electronic Mail Study in 1977 and 1978 (Mackintosh/CS&P, 1978). This model did, however, basically assume that the volume and composition of message flows would be unaffected

EXHIBIT 4-26

Illustration of simultaneity of partial demand models for 'electronic mail' and conventional mail.



by changes in mode choice and access to electronic services, though sensitivity tests involving assumptions about generated traffic were carried out.

For some purposes, however, the individual sub-models will be sufficient: for example, if we wish to know the traffic likely to be associated with a given forecast figure population of terminals, this can be forecast by a mode-choice model alone.

Choice models in practice: the track record so far

Both kinds of 'weighted factors' methods have been widely used in transportation studies both for assessing the likely impacts on traffic flows of changes in existing systems, such as parking control, new roads, or more frequent bus services (the most usual applications), or occasionally for a task much closer to that of assessing demand for a new communications medium: modelling the impact on total and modal traffic flows of either making radical qualitative changes to existing transportation modes (e.g. free public transportation or very high speed intercity rail travel) or introducing new modes (e.g. the first rail rapid transit system in a city, or 'people mover' conveyors).

There is an extensive literature, a few of whose landmarks are listed in Exhibit 4-27, describing this work. The statistical validation work for the models when applied to either the 'base year' situation, or modelling small changes, show that the models have been highly successful. Whether they have worked well in dealing with the 'new mode' situation is much more difficult to say, since so few radical changes in transportation systems have in fact been implemented. The best examples are provided by new rail rapid transit systems such as BART in San Francisco and METRO in Washington, D.C. While good retrospective studies of how well the forecasting work performed do not seem to be available, the evidence suggests that the models over-estimated potential demand, probably because they gave too great a weight to 'objective' factors like speed and accessibility and not enough to 'irrational' factors like travellers' intrinsic preference for private car travel. There may well be a lesson in this for builders and users of telecommunication demand models.

Despite the obvious analogies, so far little attempt has been made to develop demand modelling tools for telecommunications similar to those which have been used with moderate success in the transportation field. Some early work has however been carried out at Communication Studies and Planning Ltd. in London. The discriminant approach has been applied to teleconferencing (the choice between travel and conferencing by loud-speaking telephone) and 'electronic mail' (the choice between mail, messenger/courier service, telex and facsimile). Both exercises were successful, with the 'electronic mail' exercise giving over 70% correct prediction of modal choice at the disaggregate level (and hence the promise of much higher accuracy and prediction of aggregate flows). This research is

Exhibit 4-27

Some 'landmarks' of the literature of econometric choice modelling

Basic theory

Luce, D. and Suppes P. (1965) "Preference, Utility, and Subjective Probability" in R. Luce, R. Bush, and E. Galanter (eds.) 'Handbook of Mathematical Psychology' III, Wiley, pp 249-410.

McFadden, D. (1974) "Conditional Logit analysis of qualitative choice behaviour" in P. Zarembka (ed.) 'Frontiers in Econometrics,' Academic Press, New York.

Transportation demand models

Quarmby, D.A. (1967) The choice of mode for the journey to work: some findings, J. Transport Economics and Policy, pp 273-314.

McLynn, J. (1973) "Disaggregate modal choice models of fully competitive type", DTM report, Alan M. Voorhees and Associates (mimeo).

Lerman, S.R. (1975) A Disaggregate Behavioural model of Urban Mobility Decisions, PhD. dissertation, M.I.T. Department of Civil Engineering Chapter 5.

Domencich, T. and McFadden, D. (1975) Urban Travel Demand: A Behavioral Analysis. North-Holland.

Early work in telecommunications

Tyler, M., Cartwright, B. and Collins, H. (1977) 'Demand for tele-conference services', Long Range Intelligence Bulletin No. 9, Post Office Telecommunications.

Williams, E. and Young, I. (1977) 'The choice to teleconference or travel amongst loudspeaking telephone users', Communications Studies Group Working Paper E/77077/wr

continuing. In addition, work is beginning on the use of the more sophisticated 'probabilistic choice model' approaches.

Chapter 5

EVIDENCE FROM THE RESEARCH EXPERIENCE - FIELD TRIALS

BACKGROUND TO THE ROLE OF FIELD TRIALS

The estimation of demand for new services in the fields of office technology and telecommunications poses a problem to the researcher or market analyst. The tried and tested techniques of demand forecasting which rest on the existence of an established time-series data set, cannot be applied in these instances. It is possible, for example, to predict with reasonable accuracy the growth of telephone traffic in the next five years. Regression equations can be calculated from historic data to give the best prediction of total telephone traffic based on indices of household income, industrial growth, fuel prices, or whatever is found to be useful in the predictive regression equation. The procedure uses aggregate data at whatever level is appropriate for the task, and whilst the regression equation is predictive, it is not necessarily descriptive of the factors which actually determine the behavior under consideration.

These techniques are not applicable to new services, such as videotex, where there are no historic statistics of use to include in a regression equation. If the same type of demand model were to be attempted, it would have to draw on an existing service or product, such as hobby magazines, which appeared to have similar features of the new service. A demand function could then be constructed for this existing service, and used to predict future demand. It would then be necessary to make some assumption as to the proportion of the predicted demand of the existing service which would be drawn off to the new service.

The alternative is to seek methods of demand forecasting which are not only predictive but also descriptive of the processes underlying the behavior concerned. By understanding why more people are making more telephone calls, or are buying larger numbers of information orientated magazines, it is possible to infer more precisely what they would do if a new service were made available to them. The reason behind such behavior is not however to be found in aggregated data for nations, regions, organizations or even households. Demand forecasting in this framework requires as its basic raw material the events and factors surrounding individual behavioral acts.

The field trial provides, first and foremost, an opportunity to gain this type of direct information on the performance of new services or systems in the context for which they are intended. For this reason it is sometimes looked upon as the best and even the only way of getting reliable data to permit decisions on the further development and refinement of new services. However, the obtaining of the field trial data is not an

end in itself. The trial is only useful if designed to yield the right data needed for demand assessment, and if a systematic demand estimation procedure exists for processing these 'raw' data into policy-relevant findings.

It is the opinion of the authors of this report, based on their extensive experience of field trials of new telecommunications services, that naive expectations of what field trials can do may be very misleading. While a well-defined and implemented field trial can provide invaluable information, an ill-conceived and inadequately planned field trial can be expensive, time-consuming, frustrating and eventually an uninformative exercise.

An early distinction should be made between different types of field research which are commonly described under the general title of 'field trials'. Exhibit 5-1 outlines the characteristics, advantages and disadvantages of three main types of field research. The 'add-on' field trial is the model which best fits the majority of field research activities on new telecommunications services. The reasons for this are varied. Some services, such as private telephone exchanges offering advanced facilities, can only be evaluated after a commitment to full implementation at a site (e.g. Tenne, 1975, 1976). Other trials view the implementation of the service as primary, with the evaluation exercise as a post hoc justification for decisions already taken. Examples of these include the UNESCO telecommunications links between Paris and Nairobi (UNESCO, 1977) and various field trials of teleconferencing systems (Phillimore, 1977; Trevains, 1978). Finally there are numerous instances in which the evaluation exercises are opportunistic, attaching themselves to leading edge implementations of new services. Specific recent examples were teleconferencing evaluations in Canada,* and the evaluations of computer-based text processing systems at Unilever (Thomas, 1976) and at the National Physical Laboratory (Bird, 1976). While the reasons for conducting 'add-on' field trials are often justified and unavoidable, the restriction in the possible information to be gained from such exercises is severe when compared with the information obtainable from a 'purpose-built' field trial or field experiment. This is illustrated by a consideration of the objectives of field research, the types of data collection required to fulfil these objectives, and the type of problems frequently encountered in field trials which hinder the attainment of the objectives. A recent exercise designed to distil the experiences of CS&P⁺ in field research on a range of telecommunications services (Young, 1978)⁺ found there were properties common to all field research activities. The major points to emerge are shown in Exhibits 5-2 through 5-4.

* Including Bell Canada's video conference system, the University of Quebec audio system, and the DOC audio system.

+ Because this study has a great deal of additional, detailed information on field trials conducted already (including elements that would be desired but were not accomplished) we have included it as Appendix C to this report.

EXHIBIT 5-1

Type of field research	Characteristics	Benefits	Costs
Field experiment	Control exerted over extraneous environmental variables. Parameters of service may be varied in course of research. Service concept not rigorously fixed	Greater Control and Precision over events to maximize research objectives	Greater intervention in natural setting of service
'Purpose-built' field trial	Service concept static, some control over context of trial by virtue of selecting the setting and participants	Some control over context, which has been selected to maximize research objectives. Context though remains fairly natural	Certain loss of precision in controlling research content. Artificial setting for research
'Add-on' field trial	Service prototype actually implemented in its final context. Research is secondary to primary aims of maximizing service utilization	Ultimate test in a context for which service was developed	Context not controlled by researcher, and research assumes secondary role

EXHIBIT 5-2 - OBJECTIVES OF FIELD TRIALS

Primary objectives:

- Determine effectiveness of the service
- Assess user acceptance
- Estimate future demand.

Secondary objectives:

- Identify components of service requiring alteration
- Identify factors which may influence use of service (including context constraints)
- Identify characteristics of high and low users of service
- Examine success of the strategy adopted to introduce the service
- Determine the requirements for user education and training programmes
- Collect detailed data on individual 'communication events' in which the field-trial system was used, as a basis for the development, testing and calibration of computer-based demand models.

Fulfilment of the primary and secondary objectives (the secondary objectives are key points of research which are required to feed into the primary objectives) optimally requires the collection of all types of data listed in Exhibit 5-3. Field trials which have been 'added-on' to services already implemented frequently preclude the possibility of gaining longitudinal, comparative and contextual data, and may find the opportunities for gathering complete data of the subjective and objective kind are restricted. Some of the problems encountered in field trials listed in Exhibit 5-4 are also more prevalent in 'add-on' trials.

The very nature of field research, when compared with carefully controlled laboratory experiments, prevents the implementation of an optimal research design. Problems such as those shown in Exhibit 5-4 can, within a specific context, be mutually interdependent. When a service is not being used sufficiently to sustain an informative evaluation exercise, it may be necessary for the researcher to devote time to stimulating activity. This has been found in the study of some in-house teleconferencing systems (Phillimore, 1977). It is however important to carefully tailor the research design such as to maximize the achievement of high priority information, possibly at the expense of gaining data of a lesser value. It should be noted that true field experiments have rarely been conducted (for examples in a range of areas see Swingle, 1973), but some aspects of telecommunications services are ideally suited to this approach (e.g. varying formats in Videotex services).

It is fundamental and essential to appreciate that even with ideal design, the levels of demand encountered in a field trial--measured for example by hours of use, or dollars of expenditure per user per week--must not be taken literally and directly as an indication of the likely demand for a full-scale system, for a variety of reasons summarized in Exhibit 5-5. Great care must be taken in the interpretation of field trial data, and indeed it is a serious error, and one very often made, to allocate inadequate resources to the interpretation and design stages by comparison with the field trial operations and data collection efforts themselves.

Interpretation can be qualitative, or can involve the use of the field trial data in a demand model of the kind described in the latter part of the previous Chapter. In the following pages, we review some of the valuable past results obtained from qualitative interpretation of field-trial data before going on to explore the possibilities--so far very little exploited--for use of field-trial data in demand modelling.

EXHIBIT 5-3 - DATA REQUIREMENTS OF A COMPREHENSIVE FIELD TRIAL

- Subjective data: Attitudes from users to the service, reasons for use/non-use, knowledge and awareness of the capability of the service, subjective estimates of levels of use, opinions of possible improvements
 - Objective data in summary form: Frequency of use of services, costs of use, collected automatically where possible
 - *● Objective data: disaggregate choice data base. Detailed records of individual occasions when the field trial system was used, described in sufficient detail
 - Comparative data: Data from other, possibly competing, services against which the subjective and objective data can be compared
 - *● Disaggregate 'control' data: Collection of data on occasions when other services were used in same format as type 3 data, to provide full data base capable of supporting analysis of choice probabilities between the field trial service and other services
 - Longitudinal data: Sets of data should be collected prior to the introduction of a new service (this can be one source of comparative data) and preferably at more than one time point after the introduction, to take account of learning effects and any 'novelty use' effects
 - Contextual data: Information on the context into which the service is being placed
- * Note: These types of data need only be collected when a specific field trial is intended to support the development of a demand model.

EXHIBIT 5-4 - PROBLEMS ENCOUNTERED IN FIELD TRIALS

- Research initiated too late to permit a thorough evaluation
- Insufficient level of use of a service during trial to conduct evaluation
- Research inhibits or overstimulates level of use of a service, giving a distorted estimate of future demand
- Focus of research unduly restricted by internal politics of service providers and/or system operators
- Researchers have to act as enablers to get service introduced, which impedes their role as unbiased evaluators

EXHIBIT 5-5

Reasons for divergence between demand levels observed in field trial and potential demand for full-scale service

Field trial demand levels may be misleadingly high because of:

- 'novelty' or 'Hawthorne' effect
- 'animating' effect of activity by field trial personnel that could not be reproduced in a full-scale operation because cost would be too high

Field trial demand levels may be misleadingly low because:

- Full 'utility' of which full-scale system is capable is not achieved in the trial (eg. Telidon/videotex does not have full-scale data base; message service does not have 'contact man' = adequate 'community of interest')
- Not enough time/cumulative usage (note potential for adverse interaction with previous point) for full 'learning effects' by users or suppliers
- Supportive effects of service usage becoming a formal 'norm' (as in use of telephone or television) are not obtained

SUBSTANTIVE QUALITATIVE CONCLUSIONS FROM FIELD TRIAL RESEARCH

Field research on a variety of telecommunications services including teleconferencing, text messaging, electronic publishing, and advanced switchboard facilities has shown that the software, support services, and context of a service could be equally as important as the hardware configuration in determining the success of the service. The point is clearly expressed by consideration of two of these areas. A study by Thomas (1976) of the use of word processing in an international company found that there was a substantial discrepancy in the success of two identical systems which could best be attributed to the manner in which they had been introduced to the workforce. Reviews of teleconferencing (Hough, 1977) have similarly show that the context in which a service is offered, and factors such as the accessibility of equipment are likely to strongly influence the takeup of the service.

There is an overlap between the lessons that can be learnt from previous field trials and the objectives of current field trials (see Exhibit 5-2 and Tables 1 and 2 in Appendix D) which will be greater or lesser depending on the extent to which the field trial is considered as an opportunity to learn or an opportunity to test.

The circumstances surrounding an event in a field trial may be used to advantage to identify service developments and marketing approaches, or can interfere with the successful conclusion of the trial. By absorbing the experience of previous field trials it is possible to design the research to maximize the amount to be learned from the trial and minimize the risk of failure. This section of the report aims to identify substantive issues from previous field trials so that they can be anticipated and accommodated in the demand research programme of DOC.

- Context of trial - the same service or system will not be accepted in the same way in different contexts. Two components of the context have been found to be of special importance in previous research: the organizational climate into which a new service is being introduced; and the need, latent or expressed which will be met by the service. The organizational climate may be affected by the previous history concerning innovative technological services and anxieties about the implications for future employment. Interviews conducted with operators of new word processing facilities (Unicom, report by Thomas 1976) revealed the more antagonistic attitudes to be held by operators who had already been retrained on 'intelligent' memory store typewriters and saw the Unicom system as a similar short-lived toy. The most enthusiastic operators on the other hand were those who considered the new technology to be the forerunner of future office systems and hence felt their career prospects had been enhanced by learning the use of Unicom. The negative side of

introducing new technology has not yet been exposed in field trials of office technology, but the recent industrial dispute over computerization of typesetting which has closed 'The Times' newspaper, and the inability of the BBC to implement ENG (Electronic News Gathering) after a successful field trial, for similar industrial reasons, are indicative of the employment implications of new technology getting even closer to the office sector.

The other component mentioned, of need for the service, has been best documented for teleconferencing services (Stapley, 1974, Holloway and Hammond, 1975). The success or failure of these services has often been found to depend less on the quality of the service and more on the attractiveness and viability of alternative means of communication. In support of this it has been found that while considerable effort has been spent looking at purpose-built teleconferencing systems with a low level of utilization, there has been a substantial level of small group teleconferencing using loud-speaking telephones (LSTs) a state of affairs that was not planned in advance but occurred spontaneously, not because the existing LST was well-designed for its purpose but because the alternative of travel for short, simple meetings was very unattractive (Williams and Young, 1977, Trevains 1978).

- Introduction of new services - the way in which new services are introduced to their user population can be instrumental in their speed of takeup. This was found in the Unicom study where two identical systems had been received in very different ways by the operators. The first group of operators had been involved in the design and implementation of the system and felt committed to it, the second group had just been brought in to a pre-determined system and were much more critical. The study is a classic example of the use of consultation in the introduction of new procedures (Coch and French, 1958).
- Training Requirements - the provision of new services is not in itself sufficient to guarantee use; some time may be required to train potential users in the capabilities of the service, or to construct comprehensive user-guides. Studies of advanced PABX facilities (Tenne, 1975, 1976) found that even over the space of a year, full use of the services offered was not being made, and that the problem was due in part at least to a lack of awareness of service capabilities.
- The impact of new services may be broader than anticipated - the use of new services often shows the manner in which they are manipulated by users to serve ends other than those anticipated. The increase in efficiency offered by centralized

word processing is not necessarily expressed as a decrease in staffing levels and associated costs. It may instead be translated to reduce the work pressure on operators and increase their job satisfaction (Thomas, 1976). Another example is the extensive use made of private message facilities on computer conferencing systems which is seemingly more successful than the conferencing practice itself.

- Importance of software (in both the technical and more general sense of the word) and backup - the relevance of the information backup to a technological service such as videotex is self-evident, and an important part of the Prestel market trial is to gather data on the adequacy of the content and form of the database. Adequate backup can be equally important to other services; for example, the experiments in the use of geostationary satellites to deliver education and health care services (eg. SITE) have found that successful applications are dependent on appropriate organization of facilities at the reception centres.

LINKAGES BETWEEN FIELD TRIALS AND OTHER DEMAND ESTIMATION WORK

It will be apparent from the discussion so far that a well-designed field trial can be used in two different 'modes', which are by no means mutually exclusive. The first involves using the data in a descriptive and 'common sense' way to make qualitative judgments: the second uses the data in setting up quantitative demand models. Very little work of the latter kind has yet been attempted, but there is very strong evidence that this type of research could be very fruitful.

Demand modelling based on data obtained by 'serendipity' (eg. spontaneous use of loudspeaking telephones for conferencing; existing use of telex and facsimile) has been successful, but the research is constrained by four kinds of difficulties:

- The low incidence of spontaneous use of new services means that random samples of communication behavior (eg. of meetings or messages) must be very large if sufficient data for analysis of choice probabilities between communication media are to be obtained.
- Samples which 'seek out' use of the new media will give statistically biased demand models unless the appropriate advanced statistical methods are used (see Manski & Lerman, 1977).

- Situations where a sufficient variety of media choices are available to allow good calibration of general choice models are rare: for example, for 'electronic mail' (in the broad sense of the term) the ideal sample would be of communicators who have a choice of mail, messenger/courier service, telex/TWX, facsimile, and communicating word processors or computer mail.
- For some new media--for example videotex--data on users' choices between the new service and existing alternatives on specific occasions simply do not exist at all.

All four kinds of difficulties could be overcome in appropriately-designed field trials with a suitable survey programme associated with each. If the survey work included detailed data on a statistically well-designed sample of specific occasions when videotex was used (and of other occasions when it could have been used but was not), the field-trial programme could provide the basis for developing demand models that could be most useful in choice analysis, in addition to providing the more traditional descriptive data.

If a 'before and after' survey design was used, including a survey prior to the start of the field trial videotex service, light could be cast on the important question of how far the introduction of videotex creates 'generated traffic' (that is, entirely new uses of information and new expenditure not previously devoted to information-related goods and services at all) and how far it simply diverts demand from other media.

METHODOLOGICAL ISSUES AND CONCLUSIONS

The experience of previous field research makes it possible to draw certain conclusions and recommendations.

- Cooperation with the host site is important - time is required in the study to assess the context into which the service trial will be introduced, and to gain full cooperation with relevant personnel at the host site.
- Unobtrusive methods of collecting objective data should be used wherever possible. These would include use of data from record systems (e.g. office records such as logs or files; message flows; or expense claims or other administrative records giving travel destinations) and using automatic recording techniques. The advantage of these methods is that they do not intrude on the normal behavior patterns of people taking part in the trial.

- Multifaceted data collection provides an opportunity to test the internal consistency of the research. The more data that are available about the impact of a service, the more reliable are the research outcomes. This is subject to limitations on the intrusion of the research and the extent to which it distorts the behavior under investigation.
- Field trials need not necessarily be large - if the objectives of a trial are specified precisely in advance, valuable information can be gained from low-cost, short duration trials. A study of the possible benefits of using communicating word processors between two offices in a government department (de Smith, 1977) tried the service over a period of 20 days, gathering precise information on all messages sent in that time. Gathering multifaceted data may best be achieved by conducting a series of small-scale trials each with limited objectives.
- Field trials can be a valuable source of data for the development of mathematical, computer based models of the likely demand for new telecommunication services. Such models could be used to analyse the sensitivity of demand to particular attributes of the new communications media, and thus identify key uncertainties. This in turn can help orient the design of future field-trial and field-trial evaluation activity to concentrate on the investigation of issues having maximum relevance to market assessment and optimisation of the attractiveness of the new service to users.

Chapter 6

EUROPEAN EXPERIENCE WITH VIDEOTEX AND TELETEXT

This chapter supplements the general discussion of field trial experience in the previous Chapter with a specific assessment of recent videotex/teletext experience in Europe. Such an assessment is relevant to the pilot study both from a methodological standpoint, in terms of the light it casts on field trials as a method of assessing the scale and character of demand for these new services, and substantively, in that there are a number of lessons learned from the European experience that may allow Canadian innovators to avoid the costs and delays involved in 'reinventing the wheel' themselves in a variety of ways.

The chapter is organized in three sub-sections. The first summarizes the present position of videotex and broadcast teletext innovation in Europe. The second reviews the main features of the various trials and test services from a methodological point of view. The third section reviews the issues or problems that have been identified, and our own conclusions that each, cast in the form of findings fairly firmly established and risks and uncertainties identified but so far unresolved.

THE FIELD TRIALS AND TEST SERVICES

Exhibits 6-1 and 6-2 list the major videotex and teletext activities in European countries, noting some of their main features. The systems including two-way communication for the user's selection of information (videotex) are listed separately from the one-way systems operating on 'frame grabbing' principles (broadcast teletext). Main points worth noting include the following:

1. Despite the widespread and highly 'visible' activity in Europe, only in two countries, the UK and Finland, has there been significant experience with 'real users' of the systems who have been sold the service by an operating agency, and who are currently paying for it. The UK tariffs are shown in Exhibit 6-3.
2. The implementation of a videotex or teletext system, especially a videotex system, is a major undertaking, of which the terminal and computer centre technology is only a part, and not necessarily the largest in terms of cost and manpower. The UK Post Office has been committed to spending £23 million (about \$52 million Cdn) over the two calendar years 1978/1979. These figures do not include the expenditures by Information Providers or by the manufacturing industries involved, which are hard to estimate but many well be in the region of \$10 million Cdn each. Provisional authorities exist for expenditure of some £100 million by 1983 but present expenditure is believed to be in the region of £2 million per month. The present objective is to have ten computer centres, supporting as many as 10,000 users, in

EXHIBIT 6-1 - EUROPEAN FIELD TRIALS AND TEST SERVICES: VIDEOTEX*

Country	Current Business Name of Service	Location	Main operating agency	Timing	Scale	Remarks
Finland	Telset	Demonstrations	Helsinki Telephone Company/Oy Nokia Electronics/Sanoma publishing	1977-1978-	very small 30 terminals	Unusual in integrating carrier and editorial/IP activity
		Market trial Helsinki				
France	Teltel	Demonstrations	PTT	1977-	a few terminals	Early 'Antiope' version of videotex
		Velizey (Paris)	PTT	late 1980-	2500 households	Standard 'Antiope' version of videotex
		Ille-et-Vilaine	PTT	1981?*	1,000 users	Telephone directories application only, initially will have limited keyword-search capability
Germany (Federal Republic)	Bildschirm-text	various demonstrations	Deutsche Bundespost	1977-	very small	Began in Berlin Radio Fair (Finkausstellg) 1977
		Dusseldorf	Deutsche Bundespost	1980-	~2,000 households, no businesses	Emphasis on transaction service with interface to IFs own computers (eg mail order houses, airlines)
		Wilmsdorf (Berlin)	Bundespost/BMPT**	1981?*	2,000-3,000 users	Use of optical fibres. Probably mosaic-like terminal but with 'pel-addressable' capability with graphic elements
Spain	name unknown	Madrid plus some other locations	CNTE (National Telephone Co. of Spain)	December 1979-	800 users (some business)	Very similar to Prestel
Sweden	Data-vision	Demonstrations	Televerket (Swedish PTT)	1978-March 1979	very small 50 users	Future action will depend on government committee now considering policies for new media
		Pilot trial				
United Kingdom	Prestel	Various demonstrations	Post Office Telecommunications (Viewdata Executive)	1972-	about 100 terminals	First demonstrations of viewdata/videotex concept
		Test service London, Birmingham, Norwich		1978-	(see Exhibits 6-5 and 6-6)	Free-format message service abandoned until 1985; 'action frame' limited transaction capability now implemented
		Public service same cities but planned to expand to nine others late 1979		Spring/Summer 1979-	Unlimited--no formal target; hope for no. of users 100,000 in 1981	Beginnings of update net-working to support local videotex centres

* Small scale demonstrations in some countries not included.

** Federal Ministry of Research and Technology (Bundesministerium für Forschung und Technologie)

EXHIBIT 6-2 - EUROPEAN FIELD TRIALS AND TEST SERVICES: BROADCAST TELETEXT

Country	Service Name	Organizing Agency	Location/ Application	Timing	Scale	Special features/comments
France	Antiope	TDF (broadcast transmission monopoly)	small-scale demonstrations	1977-	small	Intention is to ultimately integrate broadcast Antiope and wired Teltel: no sign of implementation of this yet
			Paris stock exchange	1977-(Paris) 1978-(Lyon)	20 users	
			Meteorological office	1979-(Paris)	12 locations	
Germany (Federal Republic)	Video-test Bildschirm-zeitung	Public broadcasting agencies ARD/ZDF BDZV: German newspapers publishers associations	Demonstrations	1977-	small	Legal/constitutional controversies over roles of broadcasting, newspapers, etc.
			Public service	1979-80?	national	
			Demonstrations	1977-	small	
Sweden	Text-TV	Sveriges Radio (Swedish State Radio and TV)	Demonstrations	1977-	small	
United Kingdom	Ceefax	BBC	National public service	1978-test service since 1974	Number of terminals not known; estimate end-1978-12,000; forecast end-1979 250,000. No usage data.	Government (Home Office) licensing as a permanent service in 1978
	Oracle	Independent Broadcasting Authority		1978-test service interrupted by strike in 1977		

EXHIBIT 6-3 - TARIFFS FOR BRITISH POST OFFICE'S PRESTEL VIDEOTEX
(OR VIEWDATA) SERVICE (£1=\$Canadian 2.4)

User Tariffs

- terminals £12 - £18 per month
- call charge local call rate
- frame charge 0.5p per frame + IP charge
- installation charge nil during trial

Information Provider Tariffs

- frames £1 per frame per annum
- editing terminal
 - i) connection charge £30
 - ii) rental charge £400 per annum
- call charge
 - i) editing local call rate
 - ii) user local call rate
- editing time nil during trial
- editing from a PO centre nil during trial
- magnetic tape or on-line access nil during trial
- enquiry frames
 - i) editing nil during trial
 - ii) retrieving user charge per frame
 - iii) storing £1 per frame per annum
- closed user group £250 per group per annum

Test Service Tariffs

<u>Type</u>	<u>Numbers</u>	<u>Free Period</u>	<u>Set price (per month)</u>
Residential Group A	c. 425	2 months free usage only	£12 or £15 - first 6 months £18 - second 6 months
Residential Group B	c. 425	2 months free usage only	customers existing rental - first 6 months £18 - second 6 months
Business	c. 300	nil	£18 (12 black and white)
Sponsored by IPs	c. 350	nil	£18 (12 black and white)

operation by the end of 1979*, with on the order of 400,000 pages of information in each data bank.

3. A good deal can be learned from the main innovative service features devised in each European country. Notes of the most interesting features, with a brief statement of the reasoning behind each as we understand it, are given in Exhibit 6-4.
4. Numerous unresolved problems and issues have become apparent during the research, development and trial process so far: these are addressed in a later section.

THE TRIALS AND TEST SERVICES FROM A METHODOLOGICAL PERSPECTIVE

It is important to appreciate that the various European ventures in teletext and videotex have been launched for a variety of reasons, only one of which is to investigate the likely level and nature of demand for a full-scale service. Other motivations include:

- Testing and exhibiting technology;
- Stimulating interest in the new services by government, business, potential Information Providers, or the general public;
- Pre-empting other innovators in international standard-setting or marketing competitions;
- Laying an institutional claim to control of the new medium.

A fundamental distinction that must be made is between a demonstration, a field trial and a 'test service'. In a demonstration, usage of the system is too brief, too small in scale and often too uncontrolled and inconsistent to allow any but the most impressionistic conclusions to be drawn about acceptability and likely demand; most such demonstrations are designed to serve one of the other purposes listed above. A true field trial is designed to elicit information about the effectiveness and acceptability of a new service and the likely level of demand for it, and in order to do so must meet the criteria we set out earlier in Chapter 5: essentially it must

* This target is, however, unlikely to be achieved. Manufacturers (through their association BREMA) have promised supply of 22,000 terminals by the end of 1979, but present supply is well below schedule. If the present rate of supply (much less than 100 per week) does not accelerate, even the CS&P projection (5,000 sets in service by the end of 1979) may prove over-optimistic. The constraint is clearly in supply, and not demand.

EXHIBIT 6-4

Some distinctive features of European videotex/teletext systems

Country	System(s)	Feature	Reasons Given by Operating or R&D Agency
France	Antiope/Teltel	Technical commonality of broadcast and interactive services: same data bases may feed either. Emphasis on compatibility/integration with text message services	Increased market outlets for Information Providers' product. Concept of videotex/teletext as part of more comprehensive future data communications systems
Federal Republic of Germany	Bildschirmtext	Emphasis on implementation of transaction services (eg remote shopping, travel reservations) in initial test service	Belief that information retrieval services alone will not create viable levels of demand for Bildschirmtext medium
UK	Prestel	Strong interest in early evolution to intelligent terminals and downloading of 'telesoftware'	Expected evolution to multi-function terminal, games, education, etc. Special stress on opportunities in small-business market.

- be attractive enough, adaptive enough, long enough in duration, and big enough, to succeed; that is, it must be good enough in each of these respects to avoid failing (attracting little or no lasting usage) for reasons unconnected with the inherent merits of the service being tested
- incorporate a research design capable of eliciting the desired information about impact and demand.

As also pointed out earlier, these two sets of criteria are often in conflict to varying degrees. One influential school of thought within the European videotex community takes what is in effect an extreme point of view on this issue: it can be paraphrased as follows. "Significant usage of videotex presupposes both major adaptations of attitudes and behavior by users, and a major commitment of effort, talent and imagination by Information or 'Serviceware' Providers. None of these will be achieved in a trial presented as an 'experiment': there must be a high degree of commitment to the continuation of the service, in essentially its initial form, and no 'experimental' manipulations of the trial must be allowed to detract from overall marketing effectiveness." A trial designed from this point of view can be termed a Test Service, following the terminology now being used in the U.K. A test service can and should still be designed to generate information about demand, of course. Most such information can only be gleaned from descriptive 'uncontrolled' measurement, however, although limited 'quasi-experiments' including 'treatments' and 'control groups' can be designed in to some extent.

In these terms, the four European interactive videotex trials now either in operation or at an advanced stage of design can be described as follows.

UK Post Office Prestel Test Service. In the UK Post Office service ('Prestel') a strong emphasis is evident on the entrepreneurial 'test service' character of the project, but supplemented by a survey programme, involving interviewing users before and during their membership for the test user group, and by automatic collection of usage data by appropriate computer software. The computer software had, however, as of April 1979, failed to function and generate usage data. The first statistical data are now available but were received too late to be used in the preparation of this report.*

* A few striking features may, however, be noted. In addition to the terminal rental, the average residential user spent about \$20 on user charges (exclusive of telephone call charges) in the first month, but this is tending to fall with length of familiarity with the service: some observers feel it is 'bottoming out' at about \$6/month. Corresponding figures per business terminal use are \$20 and \$12.

The only aspect of the UK Test Service that is 'experimental' in the strict sense of the term is the division of the user sample as shown in Exhibit 6-5, into a 'nominated' group and a group selected by stratified random sampling, and the subdivision of the latter group into a group paying the 'full' tariff (after an introductory period) and a subsidized group (tariff details are given in Exhibit 6-3). Recently the sample design has been somewhat modified with the structure shown in Exhibit 6-6. This latter division is of particular interest in investigating price elasticity and 'willingness to pay' for the service more generally. Exhibit 6-5 also shows some other relevant statistics of the Prestel Test Service.

Telset, Finland. The Finnish activity has had a strong Test Service character and little or no research component: no usage data were available to the authors of this report at the time of writing.

Bildschirmtext trial in Dusseldorf Federal Republic of Germany. This trial, currently in the design phase, is the most explicitly 'scientific' or 'experimental' of the European trials so far. The present design activity includes an in-depth interview survey intended to determine which types of households and businesses seem most likely to accept and use the new service, and an 'experimental design' study intended to ensure that the trial is as effective as possible in generating information about acceptability and about likely levels of demand. It is already clear that the trial will include a two group price-sensitivity test of the kind already being carried out in the UK. There will very probably be some interesting segmentation of the user sample by behavioral characteristics as well as by the socio-economic stratification which was the only segmentation used in planning the UK sample.

The design features of the proposed Berlin trial are much less clear so far, but there are signs of a 'test service' emphasis on the social dynamics of making the trial a success. Although the trial is still at least eighteen months away from implementation (and possibly more, if various legal and institutional problems are not resolved - see section on 'Issues' below), a local community steering group has been appointed to guide and 'animate' uses of the proposed system. It includes representatives of churches, local newspapers, and numerous community associations.

Telitel, France. So far, relatively little has been established about the design (from the user point of view) of the videotex trials that will begin in France in 1980. Thus far, the indications are that the approach will be very similar to that being following in the UK, with the difference that there will be a heavy emphasis on the use of videotext adaptors rather than television sets with built-in videotex circuitry.

Broadcast teletext trials. There is little to be said in this context about broadcast teletext trials, since the lack of a research and evaluation component, and the consequent dearth of demand information, is striking.

EXHIBIT 6-5 - SUB-SAMPLES OF USERS OF THE UK PRESTEL TEST SERVICE.
(LATEST FIGURES AVAILABLE ARE GIVEN, DATES SPECIFIED)

Information Providers (IPs)

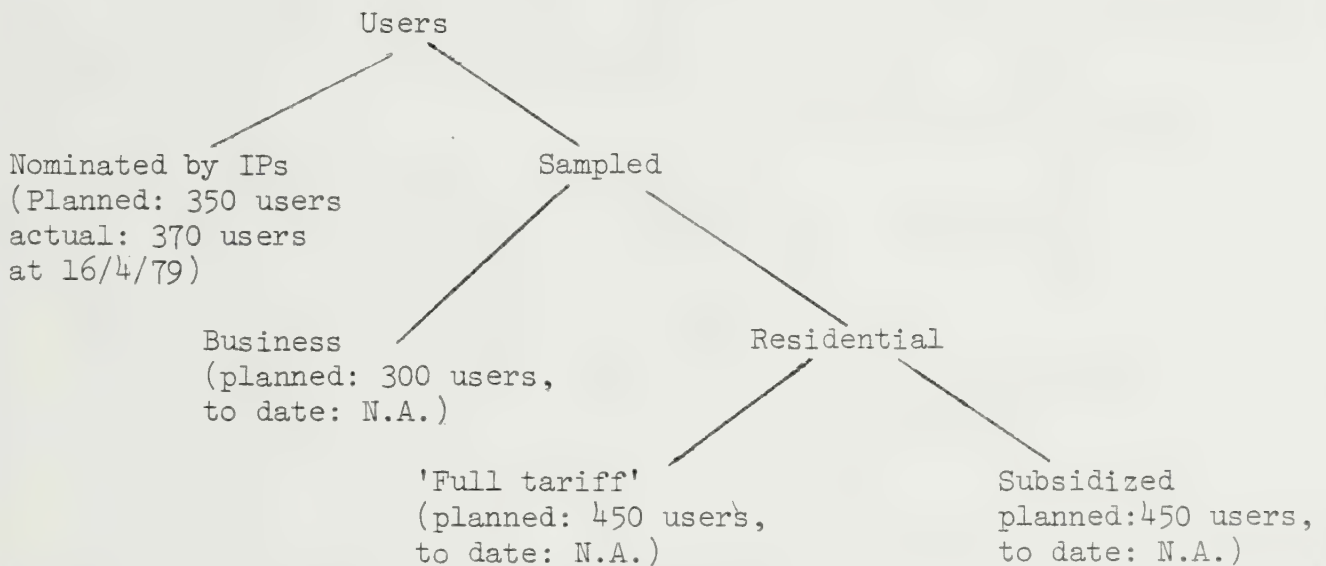
161 IPs at 29/3/79

Number of pages in use

122,000 (at 10/4/79)

Number allocated

187,975 (at 26/3/79)



actual Test Service sampled users: 533
(at 16/4/79)

actual Public Service users: 1
(at 11/4/79)

EXHIBIT 6-6

Redesign of UK Prestel Test Service sample (statement by Dr. E. Williams, head of Research Group, Viewdata Executive, May 1979)

<u>Section of sample</u>	<u>Target number of users</u>
1. Residential random	350
2. Residential 'recruited' (eg. by TV rental companies, TV manufacturers', sales organizations)	350
3. Business random sample	100
4. Business 'special' sample (nominated, etc.)	700

It is even very difficult to determine the number of working broadcast teletext terminals, and especially the amount of usage, in the UK, where the broadcast teletext systems have been in operation since 1974, and a nationwide public service has been licensed since 1978. Recent efforts by CS&P to estimate the number of broadcast teletext terminals in the UK suggested a number of somewhat in excess of 10,000: rapid expansion of the number of broadcast teletext-only terminals is regarded by many participants in the UK Prestel operation as a major threat, in that it may pre-empt purchasing decisions by high-income and innovative households who would otherwise be likely to adopt Prestel at an early stage. Broadcast Teletext is in this sense a competitor to Prestel, even though where terminals are equipped for both services, the two services are more properly regarded as complementary.

ISSUES AND PROBLEMS

Experience with videotex in various European countries has shown that the introduction of a videotex service is a much more complex matter than might have been supposed previously. Difficult issues have arisen, and give rise to continuing uncertainties, in five main areas.

- pricing and marketing strategy
- acceptability of videotex to users
- form and quality of the data base
- institutional structures and related legal and regulatory problems
- standards and interworking

The first three of these are discussed here: the fourth and fifth are omitted since regulation and political issues on the supply side of the videotex enterprise are beyond the scope of the present study of demand assessment. All the other issues have a direct bearing on the likely level of demand that will be called forth by videotex services in the real market place.

Pricing and Marketing Strategies

In the absence of good evidence about users' willingness to pay, any organization promoting a videotex system faces a fundamental dilemma: either they commit themselves to very large scale operations, including mass purchases of terminals, designed to exploit the huge economies of scale involved in the use of VLSI technology, and thus take a massive gamble on the unproven existence of a mass market with low average cost and revenue per user; or they stay with a small-scale, high-cost system. The latter alternative also has its problems: it is unlikely to be commercially attractive in the long run to organizations like telephone

companies set up to provide services on a very large scale, spreading high overheads over large numbers of users; it may leave public videotex in a marketplace where it must compete with specialized information-retrieval services optimized for specific applications (e.g. medical or legal information); and because its users are so different from the potential users of mass-market videotex it may yield rather little information about the likely behavior of the latter.

These are some of the reasons that lie behind the very promotional approach adopted in the UK Prestel Test Service, including the decision to set prices at the levels which would be profitable, according to British Post Office projections, if the service were operating at a large scale (it is hard to establish exactly what the 'break even' scale might be with the existing tariff, but CS&P studies suggest that 200,000 may be a reasonable figure. The approach has been to treat this potential scale of operation as a 'self fulfilling prophecy' - if terminal manufacturers, Information Providers and the Post Office behave, and set prices, as if the prophecy were true, it will, according to this reasoning, prove to be so.

So far this approach has worked relatively well, despite repeated setbacks in the timescale of the Prestel project (the growth of the Test Service is over 6 months behind schedule), although there are signs of strain, notably among Information Providers, where managers working on Prestel are having to fight harder for continued financial commitment, and among terminal suppliers. The price figures in Exhibit 6-7 show present add-on prices for residential terminals in the region of \$1600 - far from the original expectation of prices of \$300 above the basic television price in 1979: the difference is entirely a matter of expected scale, and reflects the cautious approach of the terminal suppliers.

Acceptance of Major System Features by Users

One would be less nervous about the 'leap in the dark' approach being adopted by the British Post Office if more were known about the possible barriers to user acceptance represented by many of the system features. Some of the deficiencies (for example poor keypad and command design, as in the cumbersome need to key sequences in using the *, # keys instead of 'forward', 'backtrack' and so on) are peculiar to the UK system and have been overcome in more recent systems such as Vista. Other acceptability issues, however, are more fundamental - notably:

- Acceptability of the very limited mosaic graphics capability of Prestel and the existing continental European videotex systems, which are very similar in this respect.* This is obviously a matter of crucial concern for the future

* The only significant difference in Antiope/Teltel for example, is the user of non-spacing control characters.

EXHIBIT 6-7

Year	No. of sets manufactured(1)		Price of sets		Cost of equivalent 26" colour TV set without Teletext or Prestel
	BREMA ⁽²⁾ predictions	Actual/latest estimate	BREMA prediction	Actual/latest estimate	
End 1978	12,000	500	-	\$2,500	\$800
April 1979	25,000	1,000		\$2,400 ⁽³⁾ \$1,500 ⁽⁴⁾	\$800
End 1981	250,000	22,000	\$1,000	\$2,000 ⁽³⁾ \$1,000 ⁽⁴⁾	\$700

(1) TV sets with integrated decoder for teletext and Prestel.

(2) British Radio and Electrical Manufacturers Association.
Predictions made in the first quarter of 1978.

(3) GEC 26" colour Prestel set for residential market.

(4) STC business Prestel terminal (black and white).

application of Telidon. There are some arguments - admittedly very tentative - that the existing acceptance of CRT-oriented information retrieval services by information workers such as librarians, scientists or airline reservation clerks indicates a degree of acceptance of simple displays for 'utilitarian' information-finding purposes. However, a more sophisticated display may be required in order to attract the less sophisticated or experienced potential users--but this 'sophistication paradox' must remain an hypothesis until tested in the field.

- Acceptance of the 'tree search' method of information retrieval and the associated delays remains largely untested.
- The match between the system's characteristics and users' indication to 'browse' in information media. For example, there is already some evidence (Tyler, 1979) that users are more likely to 'browse' during most of the time they use information media than purposefully seek out a particular item of information.

Form and Quality of the Data Base

Many observers feel that the UK Prestel data base is of very uneven quality--though it contains some excellent material and there are some people of outstanding ability in the Information Provider activity--for a variety of reasons. One of the most important is that a new medium demand new writing and graphic composition skills: existing printed material cannot be "dumped" onto it with an acceptable and attractive result except for the most straightforward and utilitarian kinds of material. The British Post Office's efforts - via the Information Provider (IP) tariff and otherwise - to persuade smaller IPs to work through a few larger, more skilled 'Umbrella IPs' is an attempt to deal with this problem.

Key examples of the problem areas here are indexing and routing, development of content forms that exploit the particular strengths of the medium (for example which use the tree structure positively, as in children's stories with multiple endings and supportive background 'browsing' material on characters, places, etc.), effective use of graphics within the limitation of the 'alpha-mosaic' medium provided by the Prestel/Antiope generation of videotex systems, and selection of material for maximum relevance and impact within the limited capacity of a videotex frame. Last but not least, the total cost - mainly labour - of data entry and updating are becoming a major issue in the economics of videotex, and are proving to be influenced to a large degree by the editing tools available - so far very limited on the Prestel system, and clearly a priority matter for future systems designers.

PART C

RESEARCH RECOMMENDATIONS

Chapter 7

DESIGN OF A METHODOLOGY FOR ASSESSING DEMAND FOR NEW HOME AND BUSINESS SERVICES IN CANADA

We have seen in the previous chapters how a wide range of methods and techniques can be made useful in analyzing potential demand for new services. In this and the following chapter, our objective is to focus on putting at least some of these methods into practice. We develop a composite approach based on both field trial and non-field trial methods, which we believe is not only feasible but also essential if the Department of Communications is to be able to assess markets for new home and business services, and the policy issues the development of these markets involves, in the best way possible. Pieces of the plan could, of course, be rearranged to suit the Department's needs. It is clear, however, that a number of different approaches to the assessment of demand carried out simultaneously or in association with one another, will always be needed. In particular, it is certain that field trials in themselves will not provide the basis for an assessment of market prospects unless:

1. the field trials have appropriate evaluation activities associated with them, which ought for best effect to begin before the field trials themselves, so that a 'base line' survey can be carried out to allow subsequent measurement of demand 'diversion' and 'generation' effects
2. the field trials and evaluations are designed with the specific information needs of the DOC and other users of demand information in mind, and
3. an explicit analytical framework is included, preferably a quantitative demand model or set of models, within which the raw data from the field trial evaluation's data collection activities are to be interpreted, to yield various forms of demand forecasts and market assessments.

The second of these points implies, in our view, two preparatory studies: one to analyse in more detail the information outputs that will be needed by the DOC and other users--i.e., a detailed management analysis task outside the scope of the present preliminary report; and the other to discover how much of this information can already be distilled from existing data sources, to at least some level of confidence based on experienced judgement, prior to the field trial work.

The third point listed above clearly requires that one or more formal analytical procedures should be set up prior to the field trial evaluation studies, specifying how the data from the field trial would be used to generate demand estimates: that is, how one would 'generalize' from the small scale and special conditions of the field trial and 'gross

up' to obtain estimates of the potential market on a national, provincial or at least city-wide scale. The process of setting up such a procedure, with the associated documentation (eg. flow charts, computer programs, data formats, etc.) would in itself be useful in classifying ideas and in specifying the information requirements that the field trial should meet, and those design features needed in the trial and the evaluation procedure.

While a disaggregate choice model approach of the kind described in Chapter 4 would clearly provide an appropriate basis for this work, this advanced methodology is as yet relatively untried in the telecommunications field. If successful, it would provide the Department of Communications with by far the most advanced set of demand-assessment tools yet available to any government communications department or public (or perhaps even private for that matter) telecommunications authority. While we are thus confident of its feasibility, we would recommend as a risk-minimizing strategy that the activity of developing a demand-estimation framework should have two separate components:

1. A low-cost, low-risk activity (but one necessarily relatively limited in analytical power) to develop a simple quantitative framework for use of the data from the field trial. This 'framework' would be designed to allow:
 - analysis of 'generation' and 'diversion' effects from examination of communication activity and expenditure data
 - 'grossing up' from the field-trial user sample to a 'universe' using appropriate socio-economic characteristics of the sample and the 'universe'.

The design activity for this simplified analytical framework would include specification of the survey instruments needed in the field trial evaluation to yield the necessary data.

2. An activity to design a disaggregate demand model giving the joint probabilities of users accepting and keeping any terminal facilities required for the service being tested, and using the service at particular levels of frequency or 'intensity'. This activity would also include detailed specifications of data requirements.

These various activities are not independent, but 'synergistic' in that each benefits from information flows from the others. Together these form in our view a coherent methodology, organized in the modular form of a logical sequence of activities. Each 'module' could be funded separately, but the omission of a major module, while not invalidating the overall process, would certainly decrease its value.

Exhibit 7-1, which summarizes the proposed methodology, illustrates by means of arrows the sequence of information flow. While there is considerable flexibility in the timing of the work, the programme should, we strongly recommend, be administered in such a way as not to violate the logic of this sequence.

Exhibit 7-2 specifies more fully the content of each of the modules described in Exhibit 7-1.

A few of the modules call for further comment additional to the remarks in Exhibit 7-2: these are Modules B-1, B-2 and C and Modules G, H, I and J taken together.

MODULE B-1: DESK RESEARCH

It is appropriate that the work plan should start with some of the simpler desk research methods, but at the same time initiate several tasks that involve field work of the leading edge and/or retrospective survey type. The key point about the desk research, to be accomplished in Module B-1, is that a great deal of new information on 'potential demand', 'likely demand', 'upper limits', and so on can be obtained with relatively little expenditure. It still takes time and effort to carry out these activities, of course, because they involve gathering data from many sources. Nevertheless, as a general rule, these methods are less costly in terms of time and manpower than other methods discussed below, because they rely principally on secondary as opposed to primary data sources.

As we have seen (Exhibit 3-1) there are five methods from the list of techniques described in Chapters 3 and 4 that can be classed as desk research. There are:

- Aggregate transaction models
- Historical analogy
- Competitive/complementary analysis
- Diffusion of innovation methods
- Hypothesized models using aggregate population data, income, household expenditures, and so on.

Of these, methods 2, 3 and 5 are particularly appropriate for the study of new home and business services. For example, taking the illustration given in Chapter 4 that 350-600,000 Telidon sets in 1986 is probably somewhat high, additional work on developing early growth information on a large number of other services and products, in addition to those

Sequence of research activities in the proposed methodology for assessment of potential demand for new home and business services

Activity Area 1

Module A
planning/
co-ordination of
definition of
outputs DOC
requires

Module B
base-line desk
analysis of
demand informa-
tion deducible
from existing
data sources

Module B-2
field work supporting
and complementing
Module B-1, include
retrospective survey
and leading edge
methods

Module C
Development of
framework for
quantitative
demand analysis

Activity Area 2

Module D
review design of field trials as
'demand experiments', seek changes
as appropriate, design field
trial evaluations

Module E
advise on design of
field trials and
services implemented
in the field trials

Module F
prepare detailed
evaluation study plan
and materials (eg.
questionnaires) for
each trial

Activity Area 3
Field Trial evaluations
repeated at each site
chosen

Module G
pre-surveys of
prospective
field-trial user
groups

Module I
'control' surveys
of non-users and
use of alternatives
to the field trial
services by trial
participants

Module H
user/usage
monitoring &
surveys

Module J
data analysis/
interpretation

Activity Area 4

Module M
use of model to
generate demand
estimates/
investigate policies
issues

Module L
'calibration':
statistical estimation
of demand model
parameters;
sensitivity tests

Module K
programs and test
demand model
system in detail,
produce supporting
documentation

EXHIBIT 7-2

Additional description of and comment on Modules in Exhibit 7-1

Module	Content	Remarks
A	Requires an analysis of DOC policy makers' real information requirements in considerable depth	Work should be done jointly by working group of DOC staff
B-1, B-2	Desk and field studies: - leading edge - complementarity/ substitutability - retrospective survey	Work should start with these activities in order to gain greatest possible advantage from existing data sources and relatively simpler analytical tools and techniques
C	Output would be detailed flowcharts, algebraic model specifications, specification of required statistical properties of data base	Output could well be organized as a 'deliberate' modelling/demand assessment manual
D	Would cover - - selection of sample - integration of survey/ data collection (including automatic data acquisition) in the field survey work	Output could be organized as working papers on field trial evaluation design
E	An 'ad hoc' but essential activity based on the analytical work in module D	Comparison of such an advisory service is thought essential to successful integration of field trial activity into demand-assessment programme - frequent visits to field trial sites by the contractors would be desirable

EXHIBIT 7-2 - continued

Module	Content	Remarks
F	Preparation of all plans and materials necessary for evaluation of each field trial included in the work plan	Output would be highly detailed eg. data formats, questionnaires/ self completion 'diaries', coding schemes, instructions to interviewers, etc.
G	Carrying out of surveys prior to start of field trial service	Two purposes can be served - optimum <u>selection</u> of user sample - collection of base line data on attributes and behaviour of user sample <u>before</u> exposure to the field trial data, for later comparison
H,I,J	Surveys and data analysis for field trials	See Recommendations, Chapter 8
K,L,M	Programming, testing and use of demand models	Models can be used for <u>policy</u> analysis (eg. sensitivity analysis of different pricing approaches as well as for estimation of potential market

discussed in Chapter 4, would be highly useful. To illustrate a few examples, it would be appropriate to gather, in one place, statistics from both Canada and the U.S. on the historical growth of cable television, pay television, personal computers, hand-held calculators, CB radios, mobile radios other than CB, video tape recorders, households with stereo sets, and perhaps even other developments somewhat farther afield. (eg., microwave ovens is not even too farfetched, because it is also an indicator of actual take-up of a new technology, albeit not one that is closely allied to telecommunications from an 'application' standpoint.)

Secondly, it is most necessary in our opinion to begin a major task of analyzing competitive and complementary forces occurring and easily foreseen. Of these, the personal computer is probably the most important, but there are others as well. It has not yet been established, for example, whether colour graphics is important, or will be important either in business or at home. As we have remarked earlier in our report, there are some arguments that simpler displays of textual information may be satisfactory overall, without the need for colour or graphics enhancement, thus leading to quite different implementation schemes, and the possibility of highly competitive terminal devices, based largely on adaptation of those already extensively used in business.

Thirdly, additional work should be carried out using more sophisticated 'hypothesized' models based on aggregate income and household expenditure data. Comparisons can be made here, for example, not only in single, large categories such as 'recreation and entertainment', but more specific categories such as proportion of households with colour television and stereo and CB radio(s), etc. At this time the exact outcome of such analysis cannot be anticipated (if it could, the research would scarcely be necessary) but it is clear that what has been accomplished with aggregate data so far is only a start.

In all of this desk research, it should be noted, the widest possible range of home and business services should be considered. It is not enough to assume, for example, that the Prestel 'information provider model' will be sufficient for Canadian users. Again as we have pointed out earlier, the market for 'passive' information retrieval may be somewhat limited, leading to strong requirements for early implementation of 'action' capabilities. These matters should also be dealt with in the desk research.

MODULE B-2: FIELD ACTIVITIES OF THE BASIC DATA-GATHERING TYPE

As described in earlier sections, it is still too early for strict 'leading edge' or 'retrospective survey' approaches in the videotex/teletext area, since there are not yet enough examples of these types of systems in operation. On the other hand, a 'monitoring' task or function of such activities is clearly needed. This would continue along the same lines as that given in the present report on European videotex/teletext

developments to date, as well as monitoring the considerable amount of activity beginning to take place in the U.S. and other parts of the world, including Japan.

The particular emphasis of this work should be on its specific relevance to, and application to, developments in Canada. Though there may, for example, be other multiclient studies forthcoming in the future, (i.e., in addition to the LINK Butler-Cox study just completed), survey and monitoring work of the type described, carried out specifically for the DOC, could and should be more structured and tailored to DOC's information requirements. This could be accomplished with a modest amount of effort and expenditure. It should, however, include adequate provision for site visits in a wide range of locations.

In addition to the above, we believe that not enough work has yet been done of the retrospective type in connection with other new home and business services. For example, although it can be shown that much information has already been gathered on past experiments, field trials, and test market activities in certain areas, relatively little effort, so far as we know, has been devoted explicitly and exclusively to those elements of such activities that relate to demand--i.e., either its estimation, or tracking of actual use. At a minimum in this endeavor, information needs to be updated from what is now available, to include, for example, early attempts at home banking (e.g., Seattle First National Bank, which did not work), present activities in this area than do seem to be working (for example, at banks in Rochester and Oneonta, New York), and other similar retrospective data.

A third activity of the 'basic data-gathering' type is also essential, i.e., piecing together all the information one can on data banks that are 'up and running' at the present time, both general and special-purpose, in both Canada and the U.S. Some of these are, of course, already known, such as Reuters Monitor Service. Here again, however, there are many others, some of which are being subsidized, but others of which are, no doubt, paying their own way. In addition to this starting activity, this task should also be expanded at some point to include all potential information providers, as well as those who have automated databases already. This would be a substantial undertaking, but it is essential in our view and should be continued into at least the second year of the research programme if Telidon/videotex activities are to be taken seriously.

MODULE C: 'SYNTHETIC' DEMAND MODELING

The third category of research we would recommend in the first phase of a non-field trial demand study programme is that concerned with the beginnings of a modeling activity. This undertaking, like all those described above, would be complementary to the field programmes, and should be designed to:

- Provide a framework for the generation of general forecasts of the level and structure of demand for new services and specifically videotex.
- Allow generalization from the results of small scale field trials by a statistically appropriate 'grossing up' process
- Provide, by means of sensitivity tests, indications of the uncertainties most in need of resolution in order to enhance the assessment of demand at the aggregate level, and thus provide guidance on which data can most usefully be collected in the field trial surveys.

This demand modeling activity should, in view of the novelty and difficulty of the work and the large inherent uncertainties involved, include several submodules using different methodologies, as described in the following recommendations, which indicate several tasks which we feel should be funded in the first year of any programme, and those which should logically be funded subsequently.

Module C - Feasibility Study Submodule. A detailed study should be funded in the first year to examine the feasibility and cost of developing and calibrating 'disaggregate choice models' of the use of information media by households and small businesses in Canada. The project should include conceptual development of submodels of the total volume of information transactions and of choice between competing media, and procedures for calibrating these models against field trial data, to the stage of formulation in algebraic and flowchart form. A key point of this study should be detailed recommendations for the design of field-trial monitoring surveys designed to generate suitable data for modelling purposes.

Module C - Expenditure-Modelling Studies. Two expenditure-modelling studies should be undertaken in the first year, one for households and one for a selected group of small businesses. These studies would examine in depth the level and structure of expenditure on information and communication goods and services; historical trends in these; and evidence on the speed at which one class of product and service can displace another.

Although Family Expenditure survey data could be used for the household study, provision for new field survey research would be needed in both of these modules. The output of the studies would then be additional realistic estimates of the upper limits of reasonable forecasts for expenditure and penetration of new videotex services.

Module C - Review of Demand-Modelling Strategies. Finally, a detailed and technical review of demand-modelling strategies should be undertaken at the end of the first year when the results of the above studies become available. At this stage, a major programme of demand modelling linked to field collection of trial user data, for testing, validation and calibration, should be considered, based on the first year's work.

FIELD TRIAL RESEARCH: MODULES G, H, I, J

Turning now to field trial research, we have indicated in Chapter 5 that such studies should include, ideally, all the following types of data, if the maximum of demand information is to be derived from the trial:

- Subjective data
- Objective data
- Comparative data, i.e., comparisons between members of the field trial user group and similar ('control group') non-users; between members of the 'user group' with high, low or zero levels of usage; and between the same users at different points in the trial, termed -
- Longitudinal data, including surveys before the start of operations
- Contextual data

Bearing in mind, of course, that this comprehensiveness is not always possible in all trials--and especially so in those that are set up for other purposes, as in most of the planned Canadian trials to date--it is possible nevertheless to outline a general program for data collection, where and when it can be obtained. It is beyond the scope of this pilot study to design a specific data collection programme for each individual trial expected to be undertaken in Canada--indeed, to do so is one of the tasks we have specified in our proposals for the future work programme. However, we believe that there should be general guidelines for the programme that can be tailored to each site as necessary, and as cooperation can be gained from the field trial operators. Such guidelines are proposed in the Recommendations which are made at the end of the next chapter.

Chapter 8

RECOMMENDATIONS FOR A DEMAND RESEARCH PROGRAMME LINKED TO CANADIAN FIELD TRIALS

In this Chapter, we indicate how the demand assessment methodology laid out in Chapter 7 might be implemented, especially with respect to demand activities linked to Canadian field trials but with earlier aspects of the programme considered briefly as well. Our recommended programme covers three years. We are confident that the recommended programme and resources for the first year could be adhered to closely: given the uncertainties about the exact nature of some of the forthcoming field trials, and the innovative nature of some of the methodologies proposed, plans for subsequent years must necessarily be more flexible.

Our general observations are grouped under three headings:

- Contracting
- Choice of locations
- Timing and sequencing

followed by a set of summary Recommendations.

GENERAL OBSERVATIONS

Contracting and DOC liaison

While it would be inappropriate for us to recommend specific criteria for selection of contractors to implement the proposed programme, we do recommend the following:

- While the whole programme need not (and probably should not) be confided to a single contractor, not more than three contractors should be involved. These contractor(s) should, ideally, create a single research team with commitment to long-term continuity of team work and team composition.
- A strong commitment of DOC staff time for liaison with the contractors and with other organizations involved in the field trials would be essential to the success of the programme.
- For best results, a high degree of continuity in the project, including a holding commitment to the three year programme to the maximum extent administrative procedures allow, is desirable. This will make it possible to build and maintain a coherent research team.

- While there is some flexibility in the assignment of modules to contractors, there are logical groupings (indicated in Exhibit 8-1) which we recommend should be adhered to.

Choice of locations

The number and choice of field trial locations which would be the subject of field-trial evaluations cannot be judged at present: to do so would require an extensive programme of visits to field trial operating agencies and locations. Such a programme should be undertaken as part of Modules D, E and F of the proposed general work programme. For demand estimation purposes large scale trials designed specifically to include demand estimation data are most appropriate; however, smaller scale trials, such as those planned for Elie, Manitoba, can also be utilized to advantage. As well, it would be ideal if the Department of Communications can work jointly and cooperatively with other innovative organizations in these new fields, such as telephone companies and cable operators, to obtain the maximum benefit from each type of trial undertaken.

Timing/sequencing

DOC staff will no doubt wish to determine the timing and sequence of the work in the light of their own budgetary administrative and policy considerations. We suggest the sequence indicated in Exhibit 8-2.

RECOMMENDATIONS

Our conclusions about the need for a programme of work on the assessment of demand for new home and business telecommunications services can be summed up in the following brief Recommendations.

Recommendation 1 - General

DOC should undertake a sponsored programme of user research designed to maximize the informational value of each of the service field trials of videotex/Telidon services undertaken in Canada, or at least a subset of these trials, with the programme extended to other new home and business services as required.

Recommendation 2 - Initial Studies

The programme should begin with desk and non-field trial research methods which have been shown in the past to elicit substantially improved estimates of demand from relatively simple model formulations and field survey methods. These would include as a minimum development of

EXHIBIT 8-1 - POSSIBLE 'PACKAGES' OF RESEARCH MODULES FOR ASSIGNMENT
TO CONTRACTORS

<u>Grouping of Modules</u>	<u>Title</u>	<u>Remarks</u>
1. <u>Module A</u>	Co-ordination, definition of information needs	Should be carried out in-house by DOC staff with assistance of a contractor, who could appropriately also be Module B contractor
2. <u>Modules B-1 and B-2</u>	Desk analyses and supporting fieldwork	Includes the range of desk research and corresponding field work specified in Chapter 7.
3. <u>Modules D, E, F</u>	Field trial evaluation: design, production of materials, provision of advisory services	Should be carried out by a team with close links to the field trials
4. <u>Modules G, H, I, J</u>	Complete field trial evaluation activities	Repeated for each field trial covered; at least one of these should be carried out by the 'Group 3' contractor, others could be allocated to other contractors as the 'manual' prepared in Module F is followed to ensure comparability of output
5. <u>Modules C, K, L, M</u>	Demand modelling	Should be carried out by a single demand model team with continuity.

Type of Activity	YEAR 1	YEAR 2	YEAR 3
Exploratory Activities	<u>Module A (planning)</u>		
	<u>Modules B-1 and B-2 (desk research and supporting fieldwork)</u>		
	<u>Module C (modelling design/feasibility studies)</u>		
Field-Trial Activities	<u>Module D (review design of field trials/ design evaluations)</u>		
	<u>Module E (advisory service)</u>		
	<u>Module F (prepare evaluation materials)</u>		
	<u>Module G (pre-surveys)</u>		
Demand Modelling		<u>Module H/I user/usage and 'control' surveys</u>	
		<u>Module J data analysis/interpretation</u>	
	<u>Module C</u>	<u>Module K (program and test)</u>	
		<u>Module L (estimate/calibrate)</u>	
		<u>Module M (use of model)</u>	

statistical indices of the growth and development of other new computer, telecommunications, and 'high-technology' products; detailed assessment of the demand characteristics of trials, demonstrations and market explorations of new services occurring elsewhere; analysis of competitive and complementary influences on the market for new home and business services as a whole and on specific products and services such as Telidon and other videotex initiatives, in particular; and exploratory market research designed to elicit what services specific groups of individuals 'say' they would be interested in, in order to compare such results with actual occurrences at later stages in the programme.

To accomplish these objectives, and to plan the overall programme in greater detail, DOC should undertake sponsorship of the first three modules outlined in this report (Modules A, B-1, and B-2) as soon as it is practical and feasible to do so.

Recommendation 3 - Preliminary Activities Related to Field Trials and Modeling

To ensure that the best use is made of the forthcoming field trial opportunities, the design of the field trials and the field trial evaluation activity should be determined as far as possible within the framework of a systematic scheme of demand assessment using formal economic and behavioral models.

To this end the research activities specified as Module C in this report should be sponsored by DOC. The maximum amount of demand information that can be obtained prior to field trial work should be obtained in the course of this preliminary work, so that field trial resources are concentrated on aspects of the work where new data are essential.

Recommendation 4 - Linkage between field trials and demand research

Advice and Assistance. The DOC programme should include the provision of advice and assistance to the field trial operators in order to ensure that the joint selection of service 'content' ('serviceware') and of different types of users is such as to yield the greatest possibility of success, combined with an acceptable capacity to yield information about the value of different types of service and content to different types of users.

Advisory Team. An advisory team, with appropriate experience and skills in social research and telecommunication field trial implementation and monitoring should be set up by DOC either in-house or under contract, to assist each field trial operator in:

1. Research design along the lines of the previous recommendations

2. Achieving a strategy for the content design, presentation, and marketing of the new service most likely to lead to greatest overall usage of the systems and services being trialed, and thus to maximum overall success.

In order to achieve these objectives, a contract should be placed for work along the lines of Modules D and E described in this report.

Recommendation 5 - Field trial data collection

Surveys. DOC should make provision by supporting Modules H to J of the work programme described in the report, for the undertaking of detailed interview and self-completion surveys of users to be included in each field trial evaluation--with interviews before, during and (where appropriate) after the trial. These surveys should be designed to determine, inter alia, the:

- Characteristics of users and their information/communication activities thought likely, on the basis of prior research, to be relevant to their behavior as regards acceptance and amount of use of the new service.
- Patterns of use of existing information/communication media to which the new service might be a substitute or complement.
- Attitudes, for example towards new technology in general, communication/information devices (such as CRTs or keyboards), and towards innovation in communication media.

The self-completion survey programme should be designed to obtain detailed descriptions of specific telecommunication events or 'transactions', eg. a 'session' at the videotex screens, or sending of a message; and of occasions when an existing telecommunication or non-telecommunications medium was preferred to the field-trial medium for the same purpose. If generation effects are to be investigated, the survey should be carried out once before the start of the field-trial service, with the same group of respondents. The duration of the self-completion survey period(s) should be short for reasons for accuracy of self-recording and of acceptability to respondents. The design of these surveys should bear in mind the potential usefulness of these surveys for the testing, validation and statistical estimation of demand models (see Recommendation 6). Adequate provision should also be made for the collection of contextual information by the field trial evaluation team, and for automatic data collection by the physical equipment used in the trials--for example statistical parameters of traffic, and utilization of different types of 'content'. (The field trial team may find it necessary to propose arrangements for the development of special-purpose software for this work).

Recommendation 6

A programme of work leading to the development and application of a family of econometric demand models, based on the 'disaggregate choice model' principle presented in this report, should be undertaken. This would involve four stages: model and data base design in the light of user requirements; programming, testing and documentation of the model; model validation and parameter estimation/calibration with real data from the field trials; and application of the model to production of demand estimates and policy analysis. (Modules C, K, L and M)

Recommendation 7

The proposed sequence of research modules should be assembled into five groups as indicated in this report (Exhibit 8-1), and provided for in research contracts covering each group. Suggested criteria for the placing of the contracts are offered in the report (Chapter 8).

Recommendation 8

That, correspondingly, budgetary provision should be made on the scale corresponding to the set of modules selected for implementation by DOC, and the number of field-trial evaluations sought.

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APPENDIX A

SOME OBSERVATIONS AND CALCULATIONS ABOUT THE MARKET POTENTIAL
FOR VIDEOTEX SERVICES IN THE RESIDENTIAL AND BUSINESS SECTORS

Appendix A

SOME OBSERVATIONS AND CALCULATIONS ABOUT THE MARKET POTENTIAL FOR VIDEOTEX SERVICES IN THE RESIDENTIAL AND BUSINESS SECTORS

In addition to the methodological study of approaches to estimating the demand for new services, the terms of reference of the present report also call for a general assessment of the likely balance of demand for videotex services in the business and residential sectors. While the resources of the present study did not permit any major quantitative analysis of demand, it has been possible to reach some provisional judgments. These are derived from 'a priori' considerations such as the various theoretical approaches reviewed in this report, overseas experience, and the study of some illustrative data on the Canadian economy. The results are presented in this appendix.

Useful starting points for the broad assessment of demand for new services are provided by general economic and behavioral factors such as the structure of household expenditure, and observed rates of diffusion of innovations, which help to set upper limits on plausible levels and rates of increase of demand; and by market segmentation, which helps to identify specific sources and types of demand to be analysed. We have drawn some early conclusions from each of these lines of enquiry.

An initial look at the upper bound on the range of demand forecasts that might be generated in a further economic analysis leads us to be somewhat more cautious than are some other sources available to the Department of Communications about the likely level of household demand for videotex in the 1980s. Exhibit A-1 summarizes some key features of the breakdown of household expenditures. It illustrates some important structural characteristics as well as the general level of expenditure available for household purchases of information media or closely related kinds of goods and services. It is clear from a study of the household expenditure data that the distribution of such expenditures is heavily skewed, being very much higher than average in high income households and also in a minority of households who have a high propensity to buy information goods and services for other reasons - for example in households whose members' occupational or educational backgrounds makes them 'information-conscious' or where parents are seeking to create a favourable learning environment for school-age children. The educational aspect of videotex - in the broadest sense of the term educational - is known to have evoked a particularly favourable response from potential users in the course of information discussions and demonstrations, not least among low income groups and households with a low level of present educational attainment.

Exhibit A-1 is based on the most recent Urban Family Expenditure studies by Statistics Canada, and takes the household as the decision-making unit. For a television-based service such as videotex, this seems

EXHIBIT A-1

Annual expenditures by urban Canadian households on goods and services potentially substitutable by videotex, 1976

(\$ Canadian, rounded to nearest dollar)

Expenditure item	Average, all households	High-income households		
		income	income	income
		\$25,000- 29,999	\$30,000- 34,999	\$35,000 or over
1. items relevant to information retrieval and games				
1.1 'Reading' (books, magazines, etc.)	102	123	132	215
1.2 Recreation (includes TV)	687	1064	1149	1572
1.3 Education	128	183	266	387
1. TOTAL	917	1371	1547	2174
2. items relevant to message service: 'communications': post, telephone, telegraph	215	253	281	355
3. average annual expenditure of group	17,908	25,216	30,228	42,030
4. average annual income of group	18,495	27,222	32,050	46,505
5. size of gross (as % of all households)	100		22.4	

Source: Statistics Canada, Urban Family Expenditure Survey, 1976.

to us appropriate, though some other studies have used a 'per capita' basis. The figures are for 1976 and all calculations here are in 1976 prices (the Consumer Price Index rose from 148.9 in 1976 (1971=100) to 186.6 in March 1979). Note that Exhibit A-1 does not include communication expenditures - notably household expenditures on postal and telephone service. Clearly such expenditures would also be relevant (that is, fall into the category of expenditure potentially substitutable by new videotex-based services) if a message facility were to be incorporated into the videotex 'package'.

A simple way to derive a judgemental estimate of possible household demand for videotex services is illustrated in Exhibit A-2. It is important to appreciate that no one of the steps can be omitted without giving a forecast which is obviously unrealistically high. Specifically, to assume that 100% of households who can 'afford' videotex (in terms of steps 1 to 4 of the procedure in Exhibit A-2) would in fact adopt it, would obviously be grossly unrealistic over a ten to fifteen year time-scale, completely ignoring the varying tastes of households, varying attitudes towards new technology in the home, and the various constraints on the diffusion of any innovation.

Taking the data in Exhibit A-2 as a starting point, consider a rough worked example. Suppose that the threshold level of expenditure on videotex is \$25 per month. (Step 1.) Suppose further that we expect the income distribution to remain the same, with average real income per household increasing at 3.5% per annum* and the share of information-oriented expenditures in the total household budgets also increasing at 3.5% per annum so that (to a first approximation) those expenditures are growing at 7% per annum - which is close to the long-term trend in Canada. (Some data on trends in family expenditures--at current prices--is given in Exhibit A-3.)

The expenditure likely to be 'available' for a new medium such as videotex can then be derived in a variety of ways. One way is to look at the expected increment in expenditure on information-related goods and services, on the argument that behavior will be much more malleable where 'new' expenditure is concerned than where a change in existing spending habits is involved. Another is to work from the figure representing the whole of the household's expenditure on 'information goods and services' but with a fairly conservative estimate of substitutability, allowing for the inevitable conservatism of households' habits in the use of information media. Purely illustrative calculations based on these different approaches are set out in Exhibit A-4; as shown there, the results fall in the range 40,000 to 80,000 videotex units in 1985. Note that if all high-income

* This is based on one of the more favourable of nine scenarios developed by the Canadian Economic Council using their 'Candide' model.

EXHIBIT A-2

A procedure for derivation of judgemental estimates of possible household demand for videotex

- STEP 1. Determine component(s) of base year household expenditure 'vulnerable' to diversion to videotex service. Total of these components is \$A.
- STEP 2. Project growth of (A) to the forecast year.
- STEP 3. Determine maximum plausible part of (A) that might be taken by videotex service in competition with other new or growing expenditure items serving similar needs. Call this (V) - potential videotex expenditure. Repeat for average household high-income households and other relevant categories of household.
- STEP 4. Determine 'threshold' videotex expenditure level (L) including terminal rental or rental equivalent of capital own planned, below which service cannot be obtained or used at a useful level.
- STEP 5. Use the distribution of household items or other relevant characteristics of households to estimate the number of households that could 'afford' videotext, ie the number for which $V > L$. This is the maximum potential demand.
- STEP 6. Judge what proportion ('penetration') of the potential demand will actually be achieved by the forecast data.

EXHIBIT A-3

Level and rate of increase of total household income, expenditure, and expenditure components relevant to demand estimation for Videotex, 1972-6 (average for all urban households in Canada. Data are quoted in current price terms and must be deflated by price indices to give change in real expenditure levels)

Year	Item					
(level of expenditure shown in \$ Canadian rounded to nearest \$)	Total Expenditure	Total Current Consumption	Reading (books, newspapers magazines)	Recreation	Education	Communications (telephone, post, etc.)
1972	10,803	8,190	63	395	99	139
1974	14,049	10,467	81	541	107	166
1976	17,908	13,204	102	687	128	215
Growth rate 1972-6 (%) rounded to nearest 0.5%	13.5	12.5	13.0	14.5	6.5	11.5

* Source: Statistics Canada Urban Family Expenditure Surveys, 1972, 1974, 1976. The survey covered (in 1976) a sample of 5,175 households in eight major urban areas

EXHIBIT A-4 - EXAMPLES OF JUDGEMENTAL ESTIMATES OF POTENTIAL VIDEOTEX DEMAND FOR 1985, BASED ON HOUSEHOLD EXPENDITURE DATA.
(ALL CALCULATIONS ARE IN \$ CANADIAN AT 1976 PRICE LEVELS.)

Base year expenditure on information related goods and services (A)
\$917/year for average household; about \$1700 for high income household.

Method 1 based on increment of $A, \Delta_1 A$, due to increasing share of information related goods and services in total income

- 3.5% annual real growth due to increasing share makes $\Delta_1 A$ \$332 for average household and \$617 for high income (top 20% approx) household by 1985
- a share of more than 25% of $\Delta_1 A$ for videotex is unlikely in view of competition by somewhat similar products, eg. videodisc, home computer, and by non-electronic goods and services competing for the same expenditure
- thus only some high income households and a few others can 'afford' \$25/month on videotex, say 5% of total households or 435,000
- if 10% of these potential user households actually take up the service by 1985, we would have 43,500 videotex households

Method 2 based on whole increment of $A(\Delta_2 A)$ due to increasing share and increasing income levels

- 7% annual real growth makes $\Delta_2 A$ \$769 for average household and \$1425 for high income household by 1985
- a share of more than 15% of $\Delta_2 A$ is unlikely because of other new electronic products plus possible expansion of existing non-electronic products and activities (a more conservative estimate is appropriate than when considering only $\Delta_1 A$)
- at this rate an inspection of the income distribution suggests that some 10% of households might 'afford' \$25/month, making 870,000 households
- with 10% penetration of this potential, we would have 87,000 videotex households in 1985

Method 3 based on total expected expenditure on information goods and services in 1985, A_{1985}

- 7% annual real growth makes A_{1985} \$1686 for the average household and \$3125 for the high income (top 20%) household
- estimates of the share of this that might be secured by videotex could vary widely: consider 5%, i.e. \$84 average or \$156 high income
- an estimation of the income/expenditure distribution then suggests that about 5% could 'afford' videotex on this basis, or 435,000 households
- if we assume a 10% penetration of this potential by 1985, we obtain a forecast of 43,500 households

Note: 8.7 million households assumed for 1985: this is based on interpolation between 1981 and 1986 estimates in Statistics Canada's Market Research Handbook 1977-1978.

households had the same uniform propensity to spend money on information systems, there would (on the assumptions in Exhibit A-4) be no demand for videotex! Our more optimistic judgement is based on the assumption that there will be a high variance of the share of expenditure going to information within the group. This could be investigated with the existing survey data and we have made provision for this in our proposal for a future work programme.

The reasonableness of such forecasts--which are essentially pure judgement, but judgement disciplined by some 'control totals' and an analytical framework--can be cross-checked by asking whether the rates of growth in absolute numbers of users or in 'penetration' rates are reasonable by comparison with historical experience with other innovations, such as the initial take-up of monochrome television, which also called for large changes in consumer behavior. These rates of increase reflecting increasing awareness and acceptance, seem unlikely to exceed those of previous very simple and attractive substitutions of one service for another--for example, the substitution of colour television for monochrome. Given that the various field trials foreseen for videotext systems in Canada in 1980 would lead to an initial 'base' of perhaps 3,000 terminals, a terminal population of 80,000 in 1985 would imply a rate of growth of terminals of nearly 100% per annum. Historical experience with innovation in household oriented (or indeed business oriented) information media would lead one to doubt the feasibility of a growth rate much faster than this, even in the very early stages. We would thus regard any higher forecast than, say, 100,000 terminals by 1985 with considerable reserve.

Turning to the business market, the question of market segmentation becomes still more crucial. Conventionally, discussion of business markets for electronic information systems tends to focus on large office operations. But small offices, professional premises, small workshops and work sites (e.g. construction sites), and retail shops are all important centres of economic activity.

There are strong arguments for caution in assessing the likely demand prospects for use of public videotex services in large business, where advanced special purpose electronic information systems, either in-house or public (as in the services offered by Lockheed, SDC and others), are already being taken up. Large businesses will probably require:

- sophisticated data-search tools for use by their professional, library or information science staffs
- integration with in-house 'office of the future' systems
- interworking with existing data terminals.

However, these criteria could conceivably be met by an advanced videotex system, which would then be complementary to the more specialized

systems: it might service the unpredictable 'generalist' information needs of, for example, research assistants or secretaries.

The small business sector is of special interest. It is of major, and often underestimated, economic importance, accounting for some 18% of all business employment in Canada.* (Some key parameters of the small-business economy are given in Exhibit A-5). This sector may well favour videotex over more specialized systems for just the same reasons that households are likely to do so: i.e., low cost and simplicity of use. Videotex may be particularly interesting when seen in conjunction with the micro-computer or intelligent terminal's function in providing simple electronic data processing for the small business. A study currently being carried out by Post Office Telecommunications in the UK has produced favourable indications about the business potential for such a 'videotex plus' system. A system including downloading of software to the intelligent terminal via videotex seems especially attractive: for functions such as payroll or tax analyses, the small business would place a considerable value on the assurance that key parameters, such as rates of social insurance deductions, are up to date - something difficult to achieve by other means.

Many of the same arguments apply to non-business ('institutional') economic units - clinics, schools, community centres, libraries and so on. Largely neglected in most discussions of videotex so far, they represent in our view a potentially promising market.

In summary, our view on the question of 'residential demand versus business demand' as posed in our terms of reference is as follows. There may be a substantial residential potential, but considerable further research investigation is needed and the higher forecasts that have entered into recent discussions should be regarded with reserve. On the other hand, potentially important institutional markets and business markets - especially in small businesses - remain to be investigated. There is no reason in the present state of knowledge to suppose that they will be less important than the residential market.

* In 1974, the most recent year for which comprehensive data on small businesses were available from Statistics Canada.

EXHIBIT A-5

Share of the small business sector in total business activity; Canada, 1974 (with varying size definitions and activity measures), 1974

Definition	Employment		total number of small businesses in category (thousands)
	% of total business employed	number employed (thousands)	
\$50,000 sales	1.5%	78	221
\$250,000 sales	5.4%	341	454
\$1 million sales	18.5%	920	478

APPENDIX B

LIST OF SERVICES

APPENDIX B

LIST OF SERVICES

A Comprehensive List of Information Transfer Services

One of the outputs of this study was to be a list of potential information transfer services for the time period of interest. This list is given in this appendix together with SRI's best estimates of the nature or characteristics of each service as expressed by the following parameters:

- Analog or digital
- One way or two way
- Low speed or high speed
- Real time or delayed transmission
- Primarily local or primarily nonlocal usage

The last variable is as a general rule highly speculative, especially for services having no operational history. Very little if any data are available to support these estimates except in special cases, such as the telephone service. It was felt, however, that attempting to describe the probable characteristics of the services would provide a framework for further analysis and perhaps some guidance for the Information Transfer Satellite Concept study, which follows this one.

Data Transmission Applications

While it is clearly not possible to list all known or foreseeable applications of computers and communications in the next decade, SRI has, during the study, performed a search of a large number of literature sources in order to accumulate and identify many of the possibilities. It is clear that this list will represent eventually only a portion of the applications that actually come into being. Furthermore, many of the services listed here may never be established. Thus, the tabulation should be considered only as a list of possible services, with the probability of establishment left undefined.

The general definition or explanation of the column headings is as follows:

Analog or digital. This refers to the basic nature or inherent signaling characteristic of the message or service, as it originates from the source instrument. It does not imply that the message must retain a particular mode of transmission from sender to receiver. Example: telephone and television are considered to be analog services, whereas all record and data services are digital. Also, facsimile is considered to be a digital service.

One way or two way. One way or two way indicates whether, as a general rule, two communicating parties or entities are "conversing": that is, whether the roles of sender and receiver are alternating back and forth during the communication. In one case, messages flow in only one direction at a time; in the other, messages flow in both directions. Example: telephone is two way, telegraph and television are one way. Communications with computers may be either one or two way depending on the nature of the service.

Low speed or high speed. In this categorization, low speed is approximately teletype speed (i.e., 150 to 300 bits per second) and high speed refers to all higher bit rates. In other studies a distinction is sometimes made between medium, or voice-grade, and high speed transmission. These categories are grouped together in the present list.

Real time or delayed transmission. The distinction in this category is in part analogous to the traditional distinction between circuit and message switching; that is, between messages that require immediate or "real time" receipt and those that may be stored and forwarded. As has been pointed out in other studies and articles, this separation is becoming more difficult to justify. Message switching does in fact take place in real time, using computers and on-line storage and retrieval systems; conversely, television broadcasts are circuit switched, but are recorded and later rebroadcast from local stations. With due regard for the lack of precision, the distinctions made should be understood to describe, in general, the urgency or time value of the various services.

Local or nonlocal. Local/nonlocal refers to geographic separation between sender and receiver. As before, the categorization is a general one and not intended to be precise. Within this constraint, however, local may be thought of as comprising the sender's local, nontoll calling area; nonlocal comprises all other areas.

Summarized Services in All Categories

<u>Voice telecommunications</u>	<u>Ana- log/ Dig- ital</u>	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time or Delayed</u>	<u>Local/ Non- local</u>
Telephone	A	2	H	RT	L
Mobile radiotelephone	A	2	H	RT	L
Network radio program transmission	A	1	H	RT	NL
<u>Video telecommunications</u>					
Network television program transmission					
Commercial broadcasting	A	1	H	RT	NL
Educational or public broadcasting*	A	1	H	RT	NL
Video telephone	A	2	H	RT	L
Closed-circuit and other special television services					
Business conferences	A	2	H	RT	NL
Stockholder's meetings	A	1 or 2	H	RT	NL
Sales meetings	A	1 or 2	H	RT	NL
State, local and national political meetings	A	1 or 2	H	RT	NL
Professional meetings	A	1 or 2	H	RT	NL
Educational uses*	A	2	H	RT	NL
Conventions	A	1 or 2	H	RT	NL

* There are, of course, a great number of specific educational uses of television. We have not attempted to identify them individually in this study. We have, however, differentiated between "ETV" and "ITV". We assume the former to be eventually included within the domain of national television networks, broadcasting throughout the nation a

	<u>Ana- log/ Dig- ital</u>	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time or Delayed</u>	<u>Local/ Non- local</u>
Catalog sales--food stores department stores, motor vehicles, real estate	A	2	H	RT	L
Electronic bussing	A	2	H	RT	NL
Specialized nationwide or regional advertising	A	1 or 2	H	RT	L
Auctions	A	1 or 2	H	RT	L
Electronic touring	A	1 or 2	H	RT	L
<u>Record, data and private wire communications</u>					
Public message telegraph	D	1	L	D	NL
Teletype service (TWX and Telex)	D	1	L	D	NL
Mobile teletype and teleprinter	D	1	L	D	L
Private wire systems	A or D	2	L or H	RT or D	NL
Data transmission*	D				
<u>Written</u>					
Books	D	1	H	D	NL
Magazines and other periodicals	D	1	H	D	NL
Newspapers	D	1	H	D	NL
Postal services	D	1	L	D	L

given number of hours per day, on the average. We assume on the other hand, that instructional television will normally fall within the domain of closed-circuit or special purposes uses of television. Thus, its inclusion in that category in the above listing.

* This list of applications in this category is given separately on the following pages.

Data Transmission Applications*

<u>Law Enforcement</u>	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Identification of stolen vehicles	2	L	RT	L
Identification of stolen items of identifiable personal property	2	L	D	L
Facsimile transmission of mug shot, finger prints and crim- inal court records	2	H	RT	NL
Gun registration	2	L	D	L
Public order surveillance--riot control	2	H	RT	L
Traffic violations	2	L	D	L
Accident records	2	L	D	L
Missing persons records	2	L	RT	L
Narcotics addicts, etc.	2	L	RT	L
Plant security--checking iden- tification cards	2	L	RT	L
Crime patterns and prediction of future activity	1	L	D	L
Identification records of hard- core criminals	2	L	D	NL
Issuance of license plates or stickers	2	L	D	NL
Collection of fees	2	L	D	L
Citizen assistance in crime detection	2	L	RT	L
Warrants	1	L	D	L

* These services are all digital in nature; thus, the first column ("analog/digital") is unnecessary and is not shown.

	<u>One Way Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Police car and unit locator system	2	L	RT	L
<u>Library Services</u>				
Public	2	L	RT or D	L
Industrial	2	L	RT or D	L
Educational institutions	2	L	RT or D	L
Research	2	L	RT or D	L
Government				
Library of Congress	2	L	RT or D	NL
National Library of Medicine	2	L	RT or D	NL
National Archives	2	L	RT or D	L
National Agricultural Library	2	L	RT or D	NL
Smithsonian Institution	2	L	RT or D	L
Remote browsing	2	H	RT	NL
Interlibrary loans--facsimile transmission of documents and pages of books	2	H	D	L
Automatic cataloging	1	L	D	L
Research and location of material	2	L	D	L
Answer reference questions	2	L	RT	L
Professional consultant service	2	L	RT	L
Distribution of reading lists	1	H	D	NL
Rapid access to documents at remote locations	2	H	RT	NL

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Library service centers	2	H	RT or D	NL
Response and delivery of materials requested	2	H	RT	NL
Medical literature analysis and retrieval (Medlars)	2	L	RT	NL
Collection and dissemination of information on short-lived phenomena	1	H	RT	NL
<u>Education</u>				
Instruction	2	L	RT	L
Instructional management	1	L	D	L
Testing	2	L	RT	L
Counseling	2	L	RT	L
Administrative planning	1	L	D	L
Information retrieval (library services)	2	L	RT	L
Lecturing	2	H	RT	L
Connecting remote campuses	2	H	RT or D	NL
Placement service	1	L	D	L
Fiscal accounting and report- ing	1	L	D	L
Instructional problem solving	2	L	RT	L
Text processing	1	L	D	L
Lab equipment accounting	1	L	D	L
Computer-assisted instruction	2	L	RT	L
Interlibrary loans	1	H	D	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Document retrieval	2	H	RT or D	L
Admissions	1	L	D	L
Registration	1	L	D	L
<u>Banking</u>				
Demand deposit accounting	2	L	RT	L
Savings accounting	2	L	RT	L
Mortgage accounting	2	L	RT	L
Credit card accounting	2	L	RT	L
Loan accounting	2	L	RT	L
Computer services for customers	1 or 2	H or L	RT or D	L
Credit authorizations	2	L	RT	L
Account balance inquiry	2	L	RT	L
Bank management system	2	L	RT	L
On-line customer services	2	L	RT	L
On-line transaction entry	2	L	RT	L
Integrated accounting	1 or 2	L	RT	L
Electronic check clearing	2	L	RT	L
Check verification	2	L	RT	L
Automatic loan payments	1 or 2	H or L	RT or D	L
Lock box remittance	1 or 2	H or L	RT or D	L
Insurance payments	1 or 2	H or L	RT or D	L
Utility billing	1 or 2	H or L	RT or D	L
Professional billing	1 or 2	H or L	RT or D	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Municipal tax billing	1 or 2	H or L	RT or D	L
Rental receipt collection	1 or 2	H or L	RT or D	L
Money transfers between government and public agencies and the pri- vate sector (welfare, Medicare)	1	H	D	NL
General ledger and payroll	2	L	RT	L
Management information and control	2	L	RT	L
<u>Investment & Securities Brokerage</u>				
Purchases and sales	2	L	RT	NL
Stock records	2	L	RT	NL
Margin accounting	2	L	RT	NL
Order matching	2	L	RT	NL
Portfolio selection	2	H or L	RT or D	NL
Optimum bond bidding	2	L	RT	NL
Analysts' opinion retrieval	2	L	RT	NL
Stock exchange	2	L	RT	NL
Quotation services	2	L	RT	NL
Cage operations				
Process stock certificates	1	H	D	L
Daily record of stock movements	1	H	D	L
Locate and determine status of a stock certificate in any phase of processing	2	L	RT	L
Instant inventory of securities	2	L	RT	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Determine what stock is available for delivery	2	L	RT	L
Over-the-counter quotations	2	L	RT	NL
Over-the-counter security sales	2	L	RT	NL
End-of-day reports to newspapers and wire services	1	H or L	D	NL
Transaction entry verification and correction	2	L	RT	NL
Data retrieval	2	L	RT	NL
Reports and analyses	1 or 2	H or L	RT or D	NL
Market trends	1 or 2	L	RT or D	NL
Buy and sell orders	2	L	RT	NL
Inquiries from brokers	2	L	RT	NL
Stock transfers	2	L	RT	NL

General Manufacturing

Scientific calculations	2	LL	RTD	L
Design automation	2	LL	RTD	L
Engineering calculations	2	LL	RTD	L
Manufacturing engineering	2	LL	RTD	L
Order entry	2	LL	RTD	L
Forecasting	2	LL	RTD	L
Requirements planning	2	LL	RTD	L
Inventory management	2	LL	RTD	L
Production capacity planning	2	LL	RTD	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Shop scheduling	2	L	RT	L
Quality control	2	L	RT	L
Process monitoring and control	2	L	RT	L
Materials handling control	2	L	RT	L
Shop floor control	2	L	RT	L
Engineering plotting	2	L	RT	L
Engineering drawings	2	L	RT	L
Computer-aided design	2	L	RT	L
Text editing	2	L	RT	L
<u>Printing and Publishing</u>				
Advertising billing	1	L	D	L
Circulation accounting	1	L	D	L
Mail subscription processing and accounting	1	L	D	L
Newsprint inventory	2	L	RT or D	L
Typesetting	1	L	RT	L
Cost estimating	1 or 2	L	RT	L
News service dissemination	1	L	RT	L
Integrated classified entry	1	L	RT	L
Book order entry	1	L	RT	L
Letter writing	2	L	RT	L
Press control	2	L	RT	L
Mailroom control	2	L	RT	L
Advanced test editing	2	L	RT	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
<u>Petroleum & Industrial Chemical Processing</u>				
Distribution planning	2	L	RT	L
Plant scheduling	2	L	RT	L
Inventory management	2	L	RT	L
Freight rate guide	2	L	RT	L
Process engineering calculations	2	L	RT	L
Project scheduling	2	L	RT	L
Process control	2	L	RT	L
Records maintenance	2	L	RT	L
Oil field automation	2	L	RT	NL
Inventory control	2	L	RT	L
Simulation	2	L	RT	L
Bulk sales invoicing and accounting	2	L	RT	L
Econometric models for manage- ment planning	2	L	RT	L
Optimum yield calculations	2	L	RT	L
<u>Wholesale & Retail Trade</u>				
Order entry and processing	2	L	RT	L
Order entry to warehouses	2	L	RT	L
Purchase order control	2	L	RT	L
Remote purchasing	2	L	RT	NL
Sales reporting	2	L	RT	L
Restaurant data collection	2	L	RT	L
Management information systems	2	L	RT	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
On-line sales reporting	2	L	RT	L
Credit bureau reporting	2	L	RT	L
Credit card charge authorization	2	L	RT	L
Credit ratings--opening new accounts	2	L	RT	L
Remote supply centers	2	L	RT	L
Vehicle routing and scheduling	2	L	RT	L
Mail order and billing	1	L	D	L
Freight billing	1	L	D	L

Insurance

New business processing	2	L	RT	NL
Policy status--maintenance and inquiry	2	L	RT	NL
Estate planning	1 or 2	L	RT or D	NL
Mortgage loan accounting	1 or 2	L	RT or D	NL
Accident and health underwriting	2	L	RT	NL
Accident and health claims	2	L	RT	NL
Endorsements	2	L	RT	NL
Renewals	2	L	RT	NL
Claims	2	L	RT	NL
Alphabetic policyholder index maintenance	2	L	RT	L

Public Utilities

Customer information system

Billing	1	H	D	L
Accounts receivable	2	L	D	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Customer inquiry	2	L	RT	L
Credit and collections	2	L	RT	L
Service order entry	2	L	RT	L
Materials management system	2	L	RT	L
General accounting	2	L	D	L
Stockholder records	2	L	RT	L
Construction management system	2	L	RT	NL
Facility planning	1	L	D	L
Electric load flow calculation	1	L	D	L
Short circuit study	1	L	D	L
Transient stability calculations	1	L	D	L
Utility meter reading	1	L	RT	L
Loss formula	1	L	D	L
Rate studies	1	L	D	L
Substation monitoring and control	2	L	RT	L
Plan management system	2	L	RT	L
Distribution management	2	L	RT	L
Economic dispatch	2	L	RT	L
Telephone directory				
Compilation	2	L	RT	L
Daily addendum for operators	2	L	RT	L
Operator rate and route inquiries	2	L	RT	L
Inter-company collect call billing	1	H or L	RT or D	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local Non- local</u>
Jet flight planning	2	L	RT	NL
Aircraft performance analysis	1	H or L	RT or D	L
Inventory control	2	L	RT	NL
Reservations systems	2	L	RT	NL
Purchasing	2	L	RT	L
Weight/Balance Optimization	2	L	RT	NL

Rail

Operations reporting	2	L	RT	NL
Car tracing	2	L	RT	NL
Purchases and stores	2	L	RT	L
Yard control	2	L	RT	L
Freight car scheduling	2	L	RT	NL
Train make-up	2	L	RT	NL
National rail data center	2	L	RT	NL
Diesel diagnostics	2	L	RT	L
Centralized billing	1	L	D	L
Waybilling	1	L	D	NL
Division information system	2	L	RT	NL
Locomotive and train scheduling	2	L	RT	NL
Train control	2	L	RT	NL
Car identification	2	L	RT	NL
Movement of cars	2	L	RT	NL
Loading and unloading	2	L	RT	NL
Car accounting	2	L	RT	NL

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Remote access computing	2	L	RT	L
Computer-assisted training	2	L	RT	L
Service order entry	2	L	RT	L
Facilities assignment for new customers	1	L	RT	L
Trouble calls and repair records	1	L	RT	L
Customer inquiries	2	L	RT	L
Information operator assistance	2	L	RT	L
Text editing	2	L	RT	L

TransportationAir

Aircraft scheduling	2	L	RT	NL
Network analysis	2	L	RT	L
Maintenance control	2	L	RT	NL
In-flight log analysis	1	L	RT	NL
Automated cargo control	2	L	RT	NL
In-flight function control	2	L	RT	NL
Weather prediction	1 or 2	H or L	RT or D	NL
Flight training simulations	2	L	RT	L
Navigation monitoring	2	L	RT	NL
In-flight maintenance moni- toring	2	L	RT	NL
Failure prediction	2	L	RT	NL
Corporate information systems	2	L	RT	NL
Crew record maintenance	2	L	RT	NL

<u>Personal & Institutional Services</u>	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Medical/Health				
Analysis of electrocardio-grams	1	L	RT or D	L or NL
Remote consultation and diagnosis	2	L	RT	L or NL
Patient monitoring	2	L	RT	L
Medical centers in under-developed countries	1	L	RT or D	NL
Billing	1	L	D	L
Dietary management	1	L	D	L
Blood bank records	2	L	RT	L
Shared hospital accounting system	2	L	RT	L
Centralized doctor billing	1	L	D	L
Hospital information systems	2	L	RT	L
Statistical and mathematical analysis	1	L	D	L
Medical information retrieval	2	L	RT	L
Multiphasic screening	2	L	RT	L
Computer-aided instruction	2	L	RT	L
Clinical records system	2	L	RT	L
Adverse drug reaction reporting	2	L	RT	L
Administrative control system	2	L	RT	L
Computer-aided diagnosis	2	L	RT	L

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
Car location	2	L	RT	NL
Shipper inquiries	2	L	RT	NL
<u>Highway</u>				
Vehicle location	2	L	RT	L or NL
Bus identification	2	L	RT	L or NL
Tracing lost shipments	2	L	RT	L or NL
Pinpointing arrivals and departures of shipments	2	L	RT	L or NL
Freight bill rating	2	L	RT	L or NL
Billing and central rating	2	L	RT	L or NL
On-line dispatching	2	L	RT	L or NL
Terminal control	2	L	RT	L or NL
Preventive maintenance scheduling	2	L	RT	L or NL
Parts inventory control	2	L	RT	L or NL
Inventory control	2	L	RT	L or NL
Remote order entry	2	L	RT	L or NL
Remote tracing	2	L	RT	L or NL
Computer-assisted dispatching	2	L	RT	L or NL
City pick up and delivery dispatching	2	L	RT	L
Dock control	2	L	RT	L
Labor forecasting	2	L	D	L
Engine analysis and diag- nostics	2	L	D	L

<u>Federal Government</u>	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
National data systems				
National Crime Information Center (FBI)	2	L	RT	NL
National Health Information Bank (HEW)	2	L	RT	NL
National Legal Information Bank (Justice Department)	2	L	RT	NL
General Services Administra- tion Data Centers (GSA)	2	L	RT	NL
U.S. Geological Survey	2	L	RT	NL
Department of Defense	2	L	RT	NL
NASA	2	L	RT	NL
Personnel records	2	L	RT	NL
Patent and copyright searches	2	L	RT	NL
Legislative status information	2	L	RT	NL
Employment skills retrieval service	2	L	RT	NL
Social security payments				
Medicare	1	H	D	NL
Welfare	1	H	D	NL
Unemployment	1	H	D	NL
Budgeting	1	L	D	L
Appropriation accounting	1	L	D	L
Military operations management	2	L	RT	NL
Project planning and scheduling	2	L	RT	NL
Transportation planning and control	2	L	RT	NL

	<u>One Way/ Two Way</u>	<u>Low Speed/ High Speed</u>	<u>Real Time/ Delayed</u>	<u>Local/ Non- local</u>
<u>Travel</u>				
Airline and other travel reservations	2	L	RT	NL
Hotel/Motel reservations	2	L	RT	NL
Camp site reservations	2	L	RT	NL
Automobile rental reservations	2	L	RT	NL
Airline and other trans- portation tickets	2	L	RT	NL
Tour planning	2	L	RT	NL
<u>Entertainment</u>				
Ticket sales				
Sports events	2	L	RT	NL
Motion pictures	2	L	RT	NL
Concerts	2	L	RT	NL
Theater	2	L	RT	NL
<u>Home communications</u>				
Shopping				
Supermarket	2	L	RT	L
Department store	2	L	RT	L
Menu planning	2	L	RT	NL
Appointments	2	L	RT	L
Home secretary	2	L	RT	L
Home protection	2	L	RT	L

APPENDIX C

MARKET SEGMENTATION AND MORPHOLOGICAL ANALYSIS

APPENDIX C

A fundamental requirement in the planning of new communication services is a disciplined framework for organizing and integrating the many existing service ideas as well as identifying "gaps" to be filled by new services.

Market researchers have evolved a variety of techniques which are helpful in developing a systematic approach to the identification and classification of new service opportunities in telecommunications. The use of market segmentation analysis (Yankelovich, 1964) in combination with product gap analysis or morphological analysis (Jantsch, 1967, Wills, 1971, Zwicky, 1962) appears particularly promising.

'Market segmentation analysis' is closely linked to analyses of 'reasons for buying'. It aims to identify the forms which a product or service should take in terms of the critical attributes and dimensions which purchasers consider when they select from a variety of products or services. It may also be helpful to divide the purchasers or potential purchasers themselves into several categories. Categories of people may be defined in, for example, socio-economic and geographic terms, and firms in terms of industry sector and some measures of size. We may also differentiate between categories in behavioral terms. Distinctions of this kind that have been found useful in other fields include those between 'innovators' and 'imitators', or 'leading edge' and other firms. Experience in marketing research suggests that the behavioral approach is particularly useful.

Once the various dimensions of classification of purchasers and the service attributes relevant to the purchasing decision have been established, a 'segmentation map' (Yankelovitch, 1964) can be drawn up to indicate the 'positions' of various products or services within the structure of the market. Yankelovitch illustrates the use of market segmentation based on surveys of 'reasons for buying' with an example from the market for watches. In his 1962 survey of purchasers' principal criterion for choice, he found that approximately 23% of buyers bought for the lowest price, 46% bought for durability and general product quality and most of the remainder bought watches as symbols of some important occasion. The relevance of this example is that it emphasizes an aspect often neglected by telecommunication planners, namely the importance of very 'irrational', emotional or personal motivation - especially by individuals and households in a non-business setting - in decisions to purchase or use goods and services. Models which are entirely 'utilitarian' in approach and regard all such motivations as purely instrumental - for example, which assume that videotex would be purchased where (and only where) it is a cost-effective information retrieval tool - are likely to be misleading.

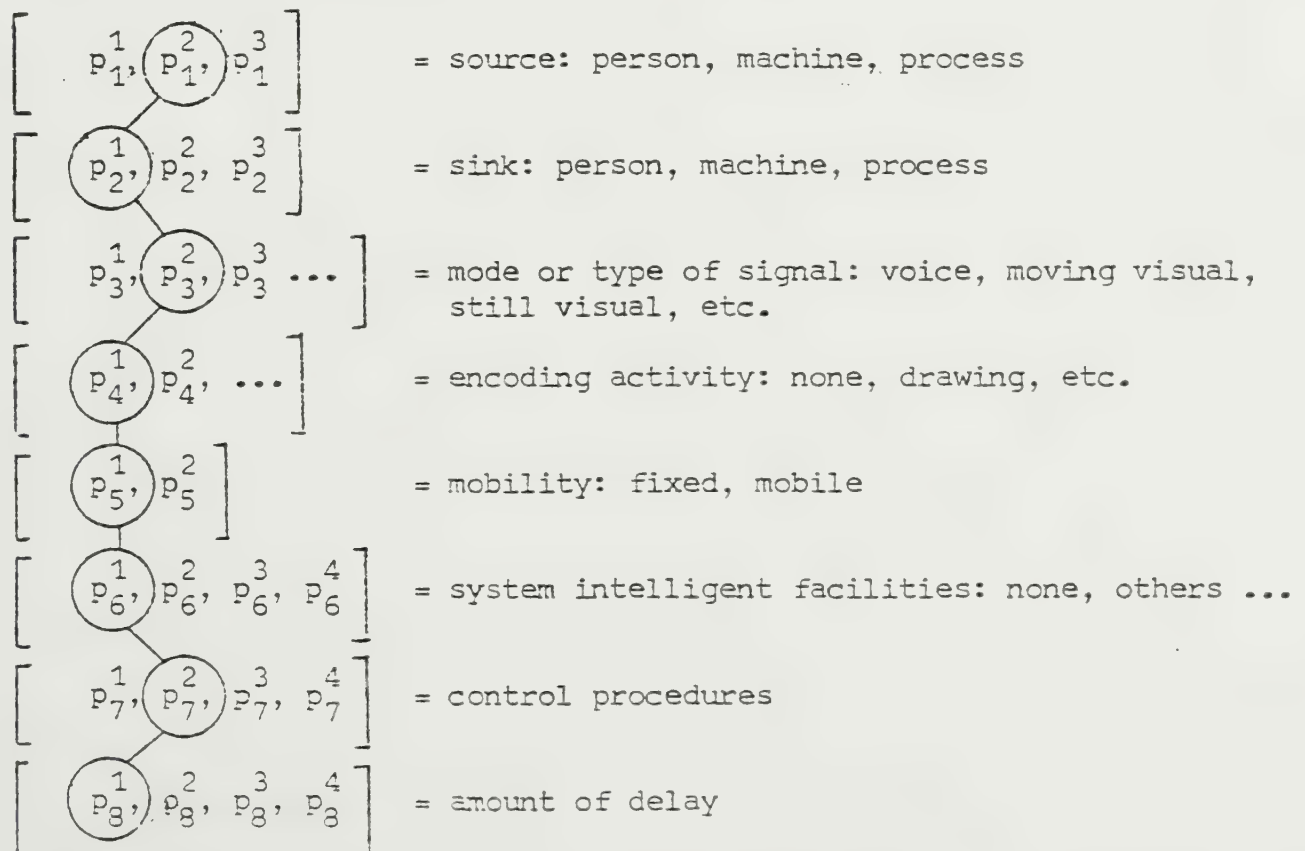
The essence of 'morphological analysis' is to describe a technology, product or service in terms of the basic parameters that 'expert judgement' and the existing literature indicate as relevant to distinguishing between distinctively different technologies, products or services. These parameters are used in formulating a 'morphological map' or matrix, which can be used to explore the full extent of the possible combinations of those parameters, thus indicating numerous innovation opportunities. (Wills, 1971). This method has mainly been applied to technological forecasting and the development of innovative technological concepts (notably at Stanford Research Institute, Jantsch, 1967, p. 181), and the Battelle Institute (McCrorry, 1966) and an example from that literature is used in Exhibit C-1. Nevertheless, the method is equally applicable to the specification of new products or services in terms of attributes relevant to users, as our example in Exhibit C-1 (freely adapted from the work of Zwicky, 1962) using our own service-classification concepts illustrates.

To specify the parameters for advanced telecommunications services, data from surveys of the 'reasons for buying' could be used. Similarly 'a priori' thinking or data on user attitudes and perceptions of telecommunication service may suggest appropriate parameters.

Example of a morphological map for new telecommunications services.*
 A number of K_i different independent irreducible values $p_i^1 p_i^2 \dots p_i^{k_i}$ are assigned for each parameter. These form a matrix written in the following scheme:

$$\begin{bmatrix} p_1^1, p_1^2, & \dots & p_1^{k_1} \\ p_2^1, p_2^2, & \dots & p_2^{k_2} \\ \dots & \dots & \dots \\ p_n^1, p_n^2, & \dots & p_n^{k_n} \end{bmatrix}$$

If one element is encircled in each row and all the circles are connected, every resulting chain of circles represents one possible solution of the original problem. The above scheme if used, to construct an n-dimensional space, leads to a morphological map as shown below:



example: machine to person moving-picture visual retrieval service
 as in on-demand films via cable television.

*Based on the methods of Zwicky (1951)

APPENDIX D

FIELD TRIAL EVALUATIONS
OF TELECOMMUNICATIONS SYSTEMS

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FIELD TRIAL EVALUATIONS
OF TELECOMMUNICATIONS SYSTEMS

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FIELD TRIAL EVALUATIONS OF TELECOMMUNICATIONS SYSTEMS

EXECUTIVE SUMMARY

The paper examines the role of the field trial in the development and initial stages of implementation of new telecommunications systems. It identifies three primary aims of field trials:

- to determine the effectiveness of the system
- to assess user acceptability
- to estimate future demand for the system.

These are backed by five more specific objectives which may be located in particular field trial studies, and which serve the primary aims.

To meet these aims and objectives requires a variety of types of data:

- subjective data
- objective data
- comparative data
- longitudinal data
- contextual data.

The experience gained in field trial evaluations by CS & P, and its predecessor, CSG, is reviewed with regard to the methods used and the main results emerging. These are then compared with the optimal strategy indicated earlier, and the successes and shortcomings examined. This process leads to the identification of a number of factors which can occur in a field trial situation and can work against the successful completion of an evaluation.

- Restricted focus of interest by system operators.
- Research team called in too late to establish a thorough evaluation exercise.
- Data required for the evaluation is not available in a usable form.
- Insufficient level of use of the system during trial period.
- Conflict of roles for researchers between 'enablers' and 'evaluators'.

- Inhibition of potential users because of excessive demands from researchers.
- Overstimulation of use by attention of research activities.

Ongoing field trial evaluations are considered with regard to the methods involved, and how they relate to the points made earlier in the paper. From these, four guides are derived for future field trial activities:

- Research activities should be multifaceted.
- They should be initiated prior to the start of the field trial.
- The cooperation of all partners in the exercise is required if coordination of the field trial and the research activities to be optimized.
- Unobtrusive methods of collecting objective data should be used whenever possible.

Finally it is considered that the future of field trials lies with the development of evaluations modules which can be assembled in a range of combinations to meet the demands of a particular field trial evaluation exercise.

FIELD TRIAL EVALUATIONS OF TELECOMMUNICATIONS SYSTEMS

1. AIMS OF FIELD TRIAL RESEARCH

1.1 The Need for Evaluative Research

Invention and innovation were at one time the product of either necessity or the dedication of a small band of people working in the interest of the glory of science (or themselves). But as technology advances, the cost of each new step becomes greater, taking research and development out of reach of the individual, and placing it in the care of corporate bodies. With this change, comes a necessary change of emphasis in motive. The marketability of a new technical development has to be ensured if the costs of that development are to be recouped.

In the sphere of telecommunications systems, an increasing proportion of the cost of development is located not in the technological advance, but in the infrastructure necessary to support an operational system. The British Post Office's Viewdata project is a notable example. The technology involved is to a large extent adapted from existing technology (e.g. remote accessing of a computer data base). The supporting infrastructure of an operational Viewdata though, requires the continuous updating of the data base, the provision of information in content and form suitable for the user, and the maintenance of the computer hardware at regional sites around the country. The cost of funding the basic research to make the system technically possible can be seen to be small in comparison with the cost of launching the operational system.

When the costs involved are so high it becomes expedient to build into the progression from technical concept to operational system a series of checks. That is points at which decisions are taken on whether to continue with the project. User research (as opposed to the research required to develop the system) can and does provide information on which such decisions can be based. Traditionally market research has been used either to identify a need for the system (a gap in the existing spectrum of services), or to gain reactions of potential users to its concept. More recently experimental studies have been invoked to gain detailed information about how potential users respond to a system (the

series of experimental studies on teleconferencing conducted at the Communications Studies Group is a notable example - see Williams, 1977).

But both these methods of research, valuable though they are, fail to capture two crucial elements of a fully operating telecommunications system. These are the context in which it will be operating, and the individual's commitment to use the system. It is only by observing and monitoring the performance of a system in a realistic setting that it is possible to make predictions with confidence as to its commercial viability. The example of the introduction of Picturephone to Chicago is in itself sufficient illustration of this point. The field trial, with appropriate monitoring, overcomes these criticisms, by putting the system into operation in the appropriate context.

It is not just the systems producers that need to conduct evaluative research on their new products. The same arguments can be applied with equal validity to potential users, particularly when a whole communications system is being considered, such as a new telephone exchange, a teleconferencing network, or an information storage and retrieval system. The potential user may indeed want even more information, on the best strategy to adopt to implement the system. The experience gained from a carefully conducted field trial will not only permit the user to make a balanced decision in future investment, but also will provide valuable guidelines for the education programmes, introduction strategies and support infrastructure necessary for the optimal application of the system.

1.2 The Objectives of a Field Trial

For most purposes in this discussion of field trials, the aims and objectives of telecommunication systems providers and users can be considered as being essentially the same with regard to field trials. There will be shifts of emphasis between the two camps, but in the interests of economy they will be treated together unless there is specific reason to do otherwise. There can be seen to be three primary aims of a comprehensive field trial:

- (i) To determine the effectiveness of the system
- (ii) To assess user acceptability
- (iii) To estimate future demand for the system.

These three aims are not independent of each other, but have been separated out to emphasize the different components. They in turn are dependent on the fulfilment of other, more specific, objectives:

- (iv) To identify components of the system which require alteration.
- (v) To identify factors which may influence use of the system (e.g. the organizational context into which it is being introduced).
- (vi) To identify the characteristics of high and low users of the system.
- (vii) To examine the success of the strategy adopted to introduce the system.
- (viii) To determine the requirements for user education and training programmes.

To meet these objectives, a variety of kinds of data are required:

- Subjective data: Attitudes from users to the system, reasons for use/non-use, knowledge and awareness of the capability of the system, subjective estimates of levels of use, opinions on possible improvements.
- Objective data: Frequency of use of system, costs of use.
- Comparative data: Bases from other, possibly competing, systems against which the subjective and objective data can be compared.
- Longitudinal data: Sets of data should be collected prior to the introduction of a new system (this can be one source of comparative data) and preferably at more than one time point after the introduction, to take account of learning effects and any 'novelty use' effects.
- Contextual data: Information on the context into which the system is being placed, such as work patterns, organizational structure, and previous history of changes.

The collection of all these types of data, and the fulfilment of all the listed aims and objectives, would constitute an optimum plan for a field trial evaluation. In practice this optimum is rarely, if ever, achieved. In the following chapters, field trial evaluations conducted

by members of the Communications Studies Group (CSG), and Communications Studies and Planning (CS&P) will be described in outline, then compared with the optimum plan described above. The reasons for the discrepancies between the optimum and the practical experience will then be discussed, and finally, ongoing field evaluation exercises will be described.

2. CS&P/CSG EXPERIENCE IN FIELD TRIAL EVALUATIONS

Communications Studies and Planning Ltd., and its predecessor, the Communications Studies Group at University College, London, have between them conducted evaluative research on field applications of systems in teleconferencing, electronic messaging systems, and advanced PABX facilities. The perspectives of these studies have been variously from the positions of the system developer and the system user. The earlier studies of field trials concentrated on the teleconferencing sphere, reflecting the original focus of CSG. As indicated in the previous chapter, and will be referred to again later on, the field trials were a necessary and natural complement to the survey and laboratory experimental research. In the other research spheres, field trials presented the only legitimate means of conducting substantive research.

In this section the field trial evaluations conducted by CS&P and CSG will be reviewed in outline within each of the spheres indicated. The reviews will concentrate on the methodologies used to evaluate the systems concerned, and on selected points to emerge from its research.

2.1 Teleconferencing

Stapley (1974) has already reviewed the early experience of field trials in teleconferencing by CSG, and has pointed to some of the problems surrounding field trial research. The research reported here will not therefore cover all the early experience of CSG, but instead will select cases which illustrate the values and problems of conducting research in the field setting.

2.1.1 The Remote Meeting Table (RMT). The RMT is a group studio-based audio teleconferencing system developed by Dr. Stapley of CSG, and subjected to evaluation on field applications in the Civil Service Department. This rare combination of evaluating simultaneously from the viewpoints of the system developer and the system user might have been

expected to create a conflict of interest. But by the nature of the commission (the RMT was designed to meet a communications need) and more importantly because of the scientific integrity of the design and evaluation team (led by Dr. Stapley), no such conflict occurred.

Evaluation of the RMT was carried out by means of a postal questionnaire to 169 users of the RMT link between London and Edinburgh. The users were identified from record sheets of all RMT meetings, 146 questionnaires were returned and subjected to analysis. The questionnaire (given in Appendix II) was concerned exclusively with the opinion of the users on the value of the system for the conduct of specific types of meeting, on the preference for various improvements to the system, and on the utility of the system. The opinion statements were elicited by 5 and 7-point Likert scales with the exception of the preference for particular improvements. To overcome the tendency by respondents to want all improvements offered, the 8 changes suggested were offered in 28 paired comparison of all possible pairs, requiring the respondent to choose at each point between two alternatives. The results of the evaluation are reported by Stapley (1973) and indicate a general level of satisfaction with the RMT for the meetings held using it. The selection of meeting activities to be held over the RMT concurred largely with the expectations derived from laboratory research on teleconferencing.

2.1.2 Confravision. The British Post Office studio-based interactive video teleconferencing system (Confravision) was subjected to a systematic 'internal' field trial in 1973 (reported by Champness, 1974). Over 200 members of the Post Office were encouraged to use Confravision between a variety of sites, over a two-month period. At the end of the Confravision meeting, all participants completed a detailed questionnaire which sought statistical information on the characteristics of the meeting (e.g. number of participants), and opinion statement on their experience and perceived use of Confravision (the questionnaire is included in Appendix II).

As with the RMT questionnaire, the opinion statements were selected to test hypotheses derived from laboratory experimental and survey research. They also shared in common the use of Likert-type scales and

semantic differential ratings. To achieve a comparison base by which opinions, statements could be interpreted, sections 6a and 7a of the questionnaire asked respondents to compare a Confravision meeting with a meeting held in a face-to-face manner or by a sound-only system. The comparisons sought were on effectiveness of conducting different types of meeting activities.

The main findings to emerge from this field evaluation of interactive video conferencing again supported predictions drawn from laboratory research. Respondents used the system for communications which were not high on interpersonal dynamics (e.g. exchanging information rather than bargaining or personnel matters). The same pattern was found for their opinion of how satisfactory Confravision would be for different meeting activities, and was highlighted when a comparison was called for between Confravision and face-to-face meetings on the same activities.

2.1.3 Other field trials in teleconferencing. The University of Quebec has an audio teleconferencing system for the purpose of university administration between its geographically dispersed centres. Evaluation exercises on this system were conducted by Short (1973) and by Thomas and Williams (1975). Short's study was restricted to informal interviews with users, whilst that by Thomas and Williams used a questionnaire based on the RMT and Confravision questionnaires. These were distributed to users over a defined period at all studio locations, and analysis was conducted on the 187 completed questionnaires returned. The main difference between this study and the previous teleconferencing trials lies in the findings on the activities meetings held over the system. These did not show a split between the interpersonal dynamic activities and the more low-key activities, all types of activity took place. On the issue of user opinions on acceptability of the system for different activities, there was though found to be the same pattern as before. It has to be concluded therefore that when the need to communicate is high and the travel option is severely restricted, then a teleconference system will be used even when it is considered to be sub-optimal for the task in hand. This type of result can only be obtained in a field trial evaluation.

The Department of the Environment installed an experimental 2-way audio-video conference system between two of their London offices. This was subjected to formal evaluation by user completed questionnaire, based on the questionnaire for the RMT, but as the number of users was particularly low, it was decided that greater exploration was required into the reasons for the failure of the system. Supplementary informal interviews were conducted with the users of the system, and reports of both formal and informal investigations are given by Christie (1973). The informal interviews, coupled with exploratory investigation of the infrastructure set up to support the system, lead the researcher to the conclusion that the main reasons for failure were first that that physical distance covered by the link was not sufficient to make teleconferencing attractive (i.e. the situation was the inverse of that prevailing in the University of Quebec), and second that there was not sufficient support and encouragement given to potential teleconference users.

2.2 Electronic Message Services

Electronic mail, messaging, text generation and editing, asynchronous store and forward messaging, there are a variety of terms to describe office systems which share common features though the functional applications are often different. The common features are the replacement of unnecessary paper in drafts of text by some form of electro-magnetic storage; editing within that store rather than on paper; and the transmission of text over the telephone network instead of by manual delivery. Evaluations of field applications have been conducted on systems designed primarily as an advanced typing pool (Unicom), as a general purpose text generating, editing and messaging service (Scrapbook), and as a distinct store and forward message service (Redactron).

2.2.1 Unicom. Unicom is a computer assisted typing service operating in Unilever Ltd. A pool of typists work directly onto computer files, the content of the file (and hence the product of their typing) being displayed on a VDU. Copies of the file, when completed, can be obtained in hard copy from a central printer, and distributed to the originator of the text for amendment and alteration. Corrected

drafts are returned to the typing pool where any of the typists can call up the appropriate file, and use the editing programme to incorporate the alterations directly on the file. A final hard copy can then be produced once more. At the time of research, two Unicom systems were in operation in different buildings within the organization. Both were operating as closed typing pools, and any communications facility between them had not been applied.

An evaluation of both Unicom systems was conducted by Hilary Thomas (1976) using semi-structured interview schedules to elicit opinion from the systems from users (both direct users, i.e. typists, and secondary users in management). In addition, the efficiency of Unicom was compared with that of the orthodox typing service using data already collected by Unilever management, and an historical perspective of the introduction of Unicom was gathered from those responsible.

Particular attention was paid in the interviews to the job satisfaction of the typists operating Unicom, whether they considered it to be an improvement in status as a downgrading and to their attitudes to the manner in which the system was introduced. The data on work output per typist indicated that both Unicom systems were operating efficiently, but the user interviews revealed a distinct difference in attitudes between the typists using Unicom I and those on Unicom II. The latter were distinctly more dissatisfied, more likely to see the system as just the latest in a long line of office 'toys'. This difference would have been difficult to interpret without the historical information on the introduction strategy adopted with the systems. The typist operating Unicom I had been involved in discussions on the design and implementation of the system prior to operationalization. Furthermore they had been the first people to use the system and had been the focus of considerable publicity both within and outside the company. None of these features applied to the typists operating Unicom II.

2.2.2 Scrapbook. Scrapbook is a system similar to Unicom, but allowing greater flexibility of use. It was developed and implemented at the National Physical Laboratory, Teddington, within the Computer Science Division. At the time of the evaluation exercise by Dr. Emma Coope (1976), two Scrapbook systems were in operation, one serving the Computer Science Division, and the other the remainder of the National Physical

Laboratory.

Evaluation was by interviews with 16 users and ex-users of both systems. The unusual location of Scrapbook (a government research laboratory) and its manner of development, meant that the user population was decidedly different from the typists with Unicom. The majority of users were scientists, with very few typists and secretaries involved.

The interviews were concerned with the users' likes and dislikes of the system. Since for the majority of users the use of Scrapbook was not a central feature of their job, it was anticipated and found that there was less concern about status and career impacts of the system than with the Unicom users. Further, as these systems 'evolved' within the organization, rather than being imposed from outside, the problem of introduction strategy did not arise. There was no comparative data available by which the effectiveness of Scrapbook could be assessed, since it replaced multiple methods of generating text (e.g. handwritten drafts, notes, typed drafts etc.).

2.2.3 Communicating word processors (Redactron). The focus of this study (de Smith, 1977) was the trial in a communication mode of two 'intelligent' typewriters (word processors), between dispersed sections of a Government Department. When standing alone, the Redactron word processors are sophisticated 'golfball' typewriters with a magnetic tape memory store, such that editing can be conducted on the magnetic memory, and final copies are produced at high speed driven by the tape memory. When two such typewriters are connected together via modems over a telephone line, they offer the facility of high speed tape-to-tape text transmission, with subsequent 'interpretation' of the message by the distant typewriter from the tape store.

The field trial was conducted over a period of 20 working days, and involved keeping a record of all transmissions over the Redactron link, and of the time required to establish and break off the telephone link. This data permitted cost comparisons to be drawn up against competing text transmission systems (telex, facsimile, and mail), and break-even points to be calculated which indicate the level of traffic required to make the communicating word processors self-financing. In addition

interviews were conducted with representatives of the government departments and sections who were the ultimate end users of the system. These interviews revealed that the main cause of an unfavourable attitude to the system was the lack of user 'education' on its capabilities. Few of the end-users realized that the system incorporated a typewriter capable of all the functions of a normal typewriter, and so therefore missed the prime benefit of the system over telex, that there was no need to retype the message as part of the sending process or, at the receiving end, to retype to give a good quality top copy.

2.3 Advanced PABX Facilities

Two evaluations have been conducted (Tenne & Williams, 1975; Tenne & Young, 1976) of the facilities offered by an advanced PABX installed in the London Head Office of Unilever. The facilities offered by this exchange were keyphones, short-code dialling, hold for referral, automatic call-back, and for a limited number of extensions, automatic rerouting to an alternative extension when called extension does not answer. Unilever were using this particular exchange in a trial capacity before selecting new exchanges for offices in Europe. Evaluations were conducted at time points within a year of the introduction of the exchange, and after two years, to see if there were any changes in use of the facilities which could be attributed to learning or to the diminishing of 'novelty' effects. On both occasions data was collected by means of a questionnaire given to 97 members of staff concerned with work-patterns, estimated frequency of use of each of the facilities, and evaluations of their usefulness (a sample questionnaire is given in Appendix II).

Results from the two studies indicated a need for education in the use of some of the facilities, and that there was no evidence of learning effects over the time period studied.

3. PRACTICAL LIMITATIONS ON FIELD TRIALS

Table 1 compares the components of the field trial evaluations described in the previous chapter with the optimum research plan described in chapter 1. Even a cursory glance at this table is sufficient to note that on many exercises the gaps in the table outnumber the checked cells. In view of this it is necessary to spend some time on two questions, first, why were these studies incomplete in their scope, and second do such incomplete studies still contain valuable information.

3.1 Factors Inhibiting Complete Evaluations

The first point to be made under this section heading is the obvious one that whilst the components listed in chapter 1 are the requirements of an optimal study, the objectives of any particular field trial may be sufficiently different that a less exacting exercise will be adequate. So for example in the earlier studies of teleconferencing, the main focus of interest was on user attitudes and opinions.

A corollary of this is that often a research team is called into a field trial evaluation too late to conduct a full-scale exercise. The example of the Department of the Environment teleconferencing link is the extreme case, where evaluation was conducted only after the experiment had been considered to be a failure. Both Unicom and Scrapbook evaluations were conducted on systems already established, such that comparative data could only be collected where it was fortuitously available from the users own records.

Even when the call for research is made sufficiently early, there is not always the opportunity to collect all the data that could be wished for. In the instance of the Confravision trial, the users were 'recruited' from within the Post Office to hold meetings within a restricted time period. Many of the meetings so called were primarily for the purpose of trying out the Confravision system, so to attempt to generate comparative data on the costs incurred and likely success of the meetings if they had been held by one set of participants travelling to see the other, would have been a highly misleading exercise. In the second of the Unilever advanced telephone facilities exercises, it was intended to gather objective data to provide backing information on the

Table 1 Components of completed field trial evaluations

Field trial	Subjective data			Objective data		Comparative data		More than 1 point in time	Contextual information
	User interviews - open	User questionnaires and closed interviews	Subj. freq. of use estimates	Freq. of use	Costs of use	Obj.	Subj.		
RMT		✓					✓		
Confravision		✓					✓		
University of Quebec		✓					✓		
Dept. of Env. Teleconf.	✓						✓		
Unicom	✓	✓			✓	✓			✓
Scrapbook	✓	✓							✓
Redactron	✓			✓	✓	✓			✓
Unilever telephone facilities		✓	✓					✓	

extent of use of various facilities, by installing an automatic traffic logger to the telephone exchange. Unfortunately there were delays to installing the necessary equipment, which made the simultaneous collection of objective and subjective data impossible. Furthermore the capacity of the traffic logger was insufficient to monitor the telephone activities of any but a small number of users at one time. Altogether therefore the objective data on facility usage on the exchange was not available in a form that was of direct value to the evaluation exercise. One of the lessons to be learned from this particular exercise is that a thorough field evaluation requires great attention to the coordination of all components, and to the gaining of the full cooperation of all parties involved.

A fourth limitation has been that the number of users of a new telecommunications system has not in all instances been sufficient to produce an adequate base for a comprehensive evaluation exercise. Where use of the system is to a large degree voluntary, then initial doubts and uncertainties of potential users may be sufficient to deter experimentation with the system. If there is an additional cost to trying the system, either direct as in the case of Confravision for which external users had to pay a fee, or indirect when learning to use the system, then rate of use can be expected to be low initially.

This can place the research team in a conflict of roles, as they try to solve a 'chicken and egg' problem. As dispassionate researchers they should just monitor the activity surrounding the system, but if this is not sufficient to allow them to conduct a thorough evaluation, should they not also try to encourage usage? However if they drum up support for use of the systems, will the users feel that they 'ought' to complete questionnaires in a favourable manner to 'please' the researchers? The danger becomes very real that the evaluation will be lead to a predetermined conclusion. An example of the dilemma, and one particular solution is a study initiated at CSG and completed at CS&P, though always directed by Lynda Phillimore. The focus of concern was the introduction of an in-house studio-based audio conferencing system at a number of sites within the ICI organization. The dilemma of the two potential roles of the research team, as 'enabler' or 'evaluator' of the system, became apparent early on. It was decided to be of greater

value to the contracting parent organization to use the accumulated knowledge of CSG/CS & P staff to encourage use of the new system rather than to evaluate what might have been a non-starter. The project was then turned into one which compared the effectiveness of different encouragement/introduction schemes. A detailed account of this exercise is given by Phillimore (1977).

The object of gaining maximal use of a new system, to provide a basis for evaluation, does not always require active encouragement on the part of the researcher, but can, nonetheless, place limitations on the activities of the research by avoiding active discouragement. If the user discovers that to make use of the system not only involves adaptation and learning, but also the completion of a 20 page questionnaire at the end, then he may well choose not to use the system. It is necessary for the researcher to weigh-up the gains of a large volume of valuable subjective data against the costs of deterring potential users.

Research can of course influence results in the other direction as well. The 'Hawthorne effect' is a familiar term derived from the intensive studies conducted on a selected group of production line workers. Whatever alterations were made to the physical working conditions, the result was virtually always the same, productivity increased. Ultimately it was assumed that these increases in productivity were a product of the attention being given to the workers rather than to any features of the environment. It has already been noted in this paper, with regard to the Unicom study, that one group of workers had a more favourable attitude to the system than others, and that these were the users of the original system and as such had been the focus of considerable publicity. In certain circumstances, research activities can have a similar 'simulating' effect which may be reflected in both the subjective (user opinion) and objective (rate of use) data.

As with the problem of swamping potential users with research questions, the possibility of the research causing an over-impressive user response, is something which the researcher has to consider taking account of the type of system and the organization into which it is

being introduced. On occasions checks are possible to pick up any heightening of dampening of usage attributable to the effects of the research activity. But this is only possible where unobtrusive objective measures of usage can be recorded for periods before, during, and after the research activity. These might be the automatic logging of telephone call rate through a PABX, records kept of the number of letters typed each week by members of a typing pool, or any other record kept 'automatically' either by machine or person.

The final limitation on a successful field trial evaluation is as obvious as the first, or even more so, that is the experience of the research team conducting the evaluation. The greater the experience, the greater the awareness of the possibilities and the pitfalls of field trials, and the greater the range of tried and tested research tools at their disposal. CS & P/CSG experience has built on each available opportunity to conduct field trial evaluations over a period of seven years. In that time there have, without doubt, been improvements in the quality and depth of the exercises conducted. This point will be demonstrated further in chapter 4 when current field trial evaluations will be discussed.

3.2 Gains from Incomplete Evaluations

The second of the questions put at the start of this chapter, asked if a field trial which failed to meet the optimum requirements could still provide valuable information. The answer is an emphatic 'Yes'. From the studies reported in chapter 2 there comes a clear picture of the need to provide adequate training and support for the use of electronic message services, text editing facilities, and new telephone facilities, in short a confirmation of the argument that the infrastructure surrounding a new technology is as important as the technology itself.

Secondly the studies in teleconferencing, and of Unicom, demonstrate that the successful use of a new system is dependent, at least in part, on the context into which it is being placed. Measures of opinion are not by themselves sufficient to predict the success or failure of a system. The expressed opinions of the respondents using the University of Quebec system were not very different from the users of other teleconferencing systems (Appendix I, Table 3, contains a diagrammatic

presentation of the opinions expressed to the same set of questions in field trial evaluations of four teleconference systems, including the University of Quebec). But the need to communicate and the un-attractiveness of the alternative means of doing so, created a climate in which the teleconference links were used more extensively than might otherwise have been anticipated.

The ability to make comparisons between field trials is of substantial importance, particularly when the range of data available for collection is restricted.

Finally it should be noted that the pointers which have emerged from these field trials, and which have been reported here, could only have come from this type of research. They are concerned with the practical aspects of a system, and its infrastructure, which are likely to lead to success or failure. None of the comparisons drawn here between, for example, different teleconference systems can be made in absolute terms of which system is superior in its own right. This type of question has to be answered under the more controlled condition of the laboratory experiment. The field trial though can, and does, provide information which cannot be gained in any other way, on how the system will perform in a particular context.

4. ONGOING FIELD TRIAL EVALUATIONS

CS & P are currently involved in three studies which can be included in the orbit of 'field trials'. Each is concerned with a different form of communication, and is at a different stage of progress. Their description is illustrative of current thinking on field trial evaluations.

4.1 Remote Meeting Table (RMT)

As the RMT is now established in its use as a studio based audio teleconferencing system, within the British Civil Service, it might appear erroneous to include the study in a paper on field 'trials'. However in the wider context of teleconferencing in general, it is still under trial. The specific objective of the present exercise is to establish reasons for use and non-use of the RMT.

Research activities to date have included the conduct of interviews with a sample of high and low users of the RMT, directed toward eliciting reasons for choosing to use/not use the RMT, deriving estimates of frequency of use, and gaining opinion on the quality of the system. In addition there has been analysis of the 'log sheets'. These are records completed for every RMT meeting, which note the number, names, and job grades of the participants, the duration and purpose of the meeting, and any comments that users may wish to record about the system. The log sheets provide objective data on levels of use, and parameters by which estimated cost-comparisons can be drawn with the hypothetical travel alternative to a face-to-face meeting. In the future it is intended to gain comparative data at the subjective level by interviewing, or sending questionnaires to, potential RMT users who have in fact chosen to travel between two RMT sites. These again will focus on the reasons for the decisions made. Comparative objective data is available in the form of records of travel expenditure for individuals between locations with RMT facilities.

Both the log sheets and the travel records are sources of data which have been compiled over an extended period of time. There is the possibility therefore to look at longitudinal patterns of communication by these two means between specific sites. However it has to be recognized that caution would be required in interpreting any trends found. Many external factors, such as changes of work pressure, and changes of task responsibilities, might be reflected in the communication pattern. As the RMT system is so well established, there is no opportunity to conduct a 'before and after' study on the introduction of an RMT link.

Finally, where effort is being concentrated on specific RMT links, information on the work context (organizational structure and departmental responsibilities) is being collected on an informal basis. An interim report on this evaluation exercise is in preparation.

4.2 Channel 40 - Local Origination Television in Milton Keynes

Channel 40 is the name of a local television service operating over a cable network in Milton Keynes. It is the most recent of six experiments in local cable television in Britain, all of which operated

under the mandate of their licence to provide programming of local interest. Channel 40 operates on a principle of 'open access', that is that any resident of Milton Keynes can make use of the equipment, skills, and distribution capabilities of Channel 40 to record, edit and transmit a programme of their choosing.

Transmission of programmes started in December 1976. Evaluative research was commissioned by the British Post Office (who own the cable network) from the Communications Studies Group, this commission has subsequently been transferred to CS&P to maintain continuity of research personnel. The objectives of the evaluation are to assess the contribution of Channel 40 to life in Milton Keynes (viewing it as one of the services of the city), and hence to assess the contribution of local-origination television to the future demand for cable services in Britain.

The evaluation exercise is being conducted in three modules, each relying on interviews for the main supply of data. One module is concerned with audience figures, audience opinions, and the general impact of Channel 40 on the population at large. This is being achieved by a series of surveys amongst residents, the first conducted prior to the start of transmission, the second after one year of transmission, and the third after two years of transmission. The impact of Channel 40 is being assessed by questions on knowledge of and involvement in the local community of Milton Keynes. A second module is also directed toward assessing the impact of Channel 40, but this time by conducting interviews with representatives of local authorities, services, and businesses which would be expected to experience any secondary effects. The third module looks at Channel 40 as a means of communication by conducting interviews with programme makers. Record sheets recording basic information about programme makers, will be kept by Channel 40 staff, and will provide a basis for the selection of interviews. They should also provide an opportunity to identify early, any programme which is intended to solicit a response from the audience. Programme makers will then be requested to keep a record of all responses as a result of their programme.

This evaluation therefore relies heavily on subjective data, even

viewing figures have to be accepted as given by interviewees. The possibilities for collecting objective data are severely restricted. The early request for research, and the subsequent cooperation of all components of the exercise; sponsors, research team and Channel 40 staff; has permitted the opportunity not only to evaluate Channel 40 in a before and after study, but also at more than one point in time so that an appreciation of the take-up of the service can be gained. There is a continual process of gathering contextual data on changes occurring in Milton Keynes.

Field work is currently underway on the first module, and will be described in an interim report due early in 1978.

4.3 The Automated Communicating Office

The third study to be included in this chapter is still at a pre-field trial stage. It involves the application of a Scrapbook/Unicom-like system to a branch of the Civil Service which operates from two major geographically separated locations. It is intended that the system will be computer based, with software permitting information storage and retrieval from any terminal (VDU) in either location, text generation and editing, and messaging between the locations.

At present a feasibility study has been conducted and is in the process of analysis. If and when the system is actually implemented, then many of the procedures and research tools used in the feasibility study would be applied again in a more detailed before and after study. The feasibility study is thus illustrative of the research methods which can be brought to bear in a field trial of advanced office equipment.

The objective of this particular study was to gain a snap-shot of the communication and information flow within a government department. Since this department is split into two locations, the same exercises were conducted at both sites. They involved:

(i) Interviews with approximately half of the members of the department. These used a structured interview schedule designed to elicit information on the tasks which comprised their job and estimates of the number of communication activities this involved, problems they has experienced in communication and information retrieval, and their

experience of and attitudes toward computer-based systems.

(ii) Gathering information on the channels of communication flow by means of a self-completed chart of personal communication contacts.

(iii) Gathering all available objective data related to communication flow from existing sources such as typing records, books recording incoming mail, telex records, records of travel claims, and RMT log sheets.

(iv) Mail tagging, that is an exercise by which a short factual questionnaire concerned with the characteristics of mail (e.g. source, whether typed, etc.) is attached to all items of mail entering the office on a specific day. The questionnaire is completed by the final recipient of each item of mail. [The mail-tagging procedure was developed by Mr. de Smith of CS & P, and is described in operation elsewhere (de Smith, 1976), the questionnaire is included in Appendix II of this report.]

In addition to these activities, this particular department was also due to take part in a week-long exercise of recording telephone calls both incoming and outgoing. The use of desk surveys of telephone traffic has already been discussed by Stapley (1976)

4.4 New Lessons

Table 2 is an extension of Table 1, but now includes the three on-going exercises in the comparison against the optimum standard described in chapter 1. It has to be recognized that as these studies are all in some sense 'ongoing' (this is projecting to the anticipated next phase of the Automated Communicating Office study), the cells of the lower part of Table 2 are completed according to the intentions of these studies, and not according to achievements.

This notwithstanding, it is apparent from the table that the on-going studies meet more of the criteria than the post studies. In looking to find the reasons for this improvement, it is possible to identify a number of features which distinguish the later from the earlier studies.

(i) All the ongoing studies have adopted a modular or multifaceted approach, rather than relying on a single research instrument.

Table 2 Components of completed and ongoing field trial evaluations

	Subjective data			Objective data		Comparative data		More than 1 point in time	Contextual information
	User interviews - open	User questionnaires and closed interviews	Subj. freq. of use estimates	Freq. of use	Costs of use	Obj.	Subj.		
Field trial									
RMT		✓					✓		
Confravision		✓					✓		
University of Quebec		✓					✓		
Dept. of Env. Teleconf.	✓						✓		
Unicom	✓	✓			✓	✓			✓
Scrapbook	✓	✓							✓
Redactron	✓			✓	✓	✓			✓
Unilever telephone facilities		✓	✓					✓	
RMT (ongoing)	✓	✓	✓	✓	✓	✓	✓	When possible	✓
Channel 40	✓	✓	✓				✓	✓	✓
ACO		✓	✓	✓	✓	✓	✓	✓	✓

(ii) Two of the studies have involved the research team at a stage early enough to permit a longitudinal study of the implementation of the system concerned.

(iii) All ongoing studies have involved a significant amount of time on the part of the research team, ensuring that good relations are maintained with all persons connected with the research activities. This has meant that the research has been seen to be of value to all key persons asked to contribute, and has therefore led to greater cooperation when activities need to be coordinated.

(iv) A greater emphasis has been placed on objective data which can be or already is collected almost unobtrusively and as a matter of course. These include typing records, mail books, log sheets, etc.

The full benefit of including as many of these features as possible into a single field trial evaluation has yet to be realized. When the current studies are completed it will be possible to identify any gaps remaining in the array of data collected, and it may be possible to begin to weight the value of the contribution made by each component of the data. However there will continue to be a need for inventiveness and adaptability on the part of the research team to extract the maximum amount of information with the minimum amount of intrusion.

5. CONCLUSION

The field trial has been found to be an extremely valuable method of evaluative research in the development or implementation of new telecommunications systems. It provides information which cannot be gained with confidence from market research or laboratory experimental techniques. However, any idea that the field trial is an 'easy' form of research, providing 'obvious' answers, should be rapidly abandoned. The potential information to be gained from a thorough field trial evaluation exercise is very large indeed, and is sufficient to provide a balanced picture of the likely success of the new telecommunications system in a wider setting. But the pitfalls which can undermine the realization of this potential are numerous, and require care if they are to be avoided.

Current field evaluation exercises being conducted at CS & P have built on the experience gained at CSG. This has not only allowed the

research tools to be tried and tested over a period of time, but has also permitted the drawing of comparisons from one study to another, which has the effect of sensitizing the research team to key issues which might otherwise be missed. The state of the art of field trials is not yet such that a ready-made 'field-trial research package' can be produced and plugged into any field-trial situation. Indeed it is the opinion of the author that such a package could not be produced in any definitive form. Field trials, by their nature, are one-off activities, every opportunity has to be taken at the time it is available, or it will be lost completely. This requires flexibility and inventiveness on the part of the research team rather than the repetitious application of a standard formula. What is more probable, and valuable, is that a number of basic research modules will be developed relevant to different types of telecommunications system. Any particular field trial evaluations will then consist of a core of a selection of these modules, with the remainder of the exercise being tailored to meet the specific requirements of the situation.

To return to the issue raised in chapter 1, with the increasing costs of developing and implementing new telecommunications systems, it becomes increasingly important to gain the information on practical application which can only be offered by a field trial. But as this in itself becomes an ever more expensive activity, so the call for good, thorough, evaluative research which is integrated with the field trial itself should become a matter of course.

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APPENDIX I

Table 3 Comparison of user reactions in four field trials of teleconferencing: University of Quebec (U of Q); Bell Canada (a video teleconferencing system evaluated in the same way as Confravision); Confravision, and the Remote Meeting Table (RMT)

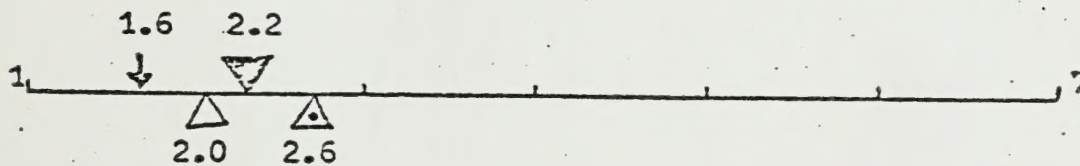
[Taken from Thomas and Williams, 1975.]

How satisfactory do you think you would find the teleconference for the following activities?

COMPLETELY
SATISFACTORY

COMPLETELY
UNSATISFACTORY

GIVING OR RECEIVING INFORMATION



Standard
Deviation

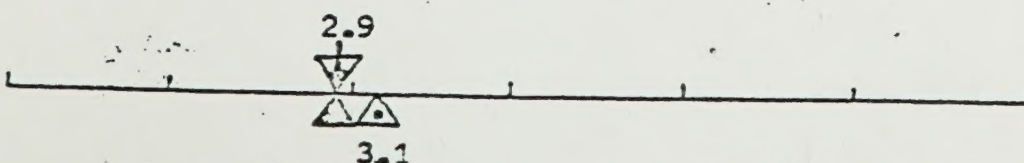
U. of Q.	0.94
Bell Canada	1.23
Confravision	0.95
R.M.T.	1.49

EXCHANGING OPINIONS



U. of Q.	1.26
Bell Canada	1.23
Confravision	0.96

DECISION MAKING



U. of Q.	1.35
Bell Canada	1.33
Confravision	1.16
R.M.T.	1.21

↓ U. of Quebec △ Bell Canada △ Confravision △ Remote Meeting Table



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